

# AAI AUTOMOTIVE INDUSTRIES

**AUTOMOTIVE and AVIATION MANUFACTURING  
ENGINEERING • PRODUCTION • MANAGEMENT**

**FEBRUARY 1, 1957**

## ***In This Issue***

**Axle Shafts Machined on New Equipment at Cadillac  
New Ford Truck Line and Packard Passenger Cars  
Annual Meeting of Society of Automotive Engineers  
Operation of the Lucas Fuel Injection System  
Automatic Machines in the Oldsmobile Engine Plant  
Developing the 750-Hp Continental Diesel Engine**

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**A C H I L T O N P U B L I C A T I O N**

*How does an oil company  
prepare men for industrial technical service work?*

## Here's how Standard Oil trains its men

At the Standard Oil training center on Chicago's south side—not far from the Company's refinery and research laboratory at Whiting, Indiana—men who have demonstrated an aptitude for such work are given a 17 week course in industrial lubrication, equipment maintenance and metal working. And thus begins the training Standard Oil gives its men who are to provide customers with lubrication technical service.

Most men selected for this Sales Engineering School have college degrees in some engineering or scientific field. And in most cases these men, prior to attending the school, have had field experience in technical service work to start them off with an appreciation of the problems industry meets in lubricating equipment and working with metal.

This course for lubrication specialists and engineers includes lectures and work in chemical laboratory, engine

laboratory and machine shop. Senior Standard Oil men, authorities on lubrication and metal working, are the instructors. Other Standard Oilers with teaching skills and extensive field experience, conduct classes, direct the shop work and supervise the school's laboratories.

Class, shop and lab work are augmented by field trips to plants where "students" learn first-hand more about the lubrication problems confronting industrial customers.

The Standard Oil Sales Engineering School has graduated 15 of these classes. The many men who have completed the course are now serving customers out of Standard's 23 offices in fifteen Midwest and Rocky Mountain states. Would you like one of these men to call on you? Then telephone your nearby Standard Oil office. Or write to the Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

*Lectures, shop and lab work  
comprise training course.*



**STANDARD OIL COMPANY**  
(Indiana)

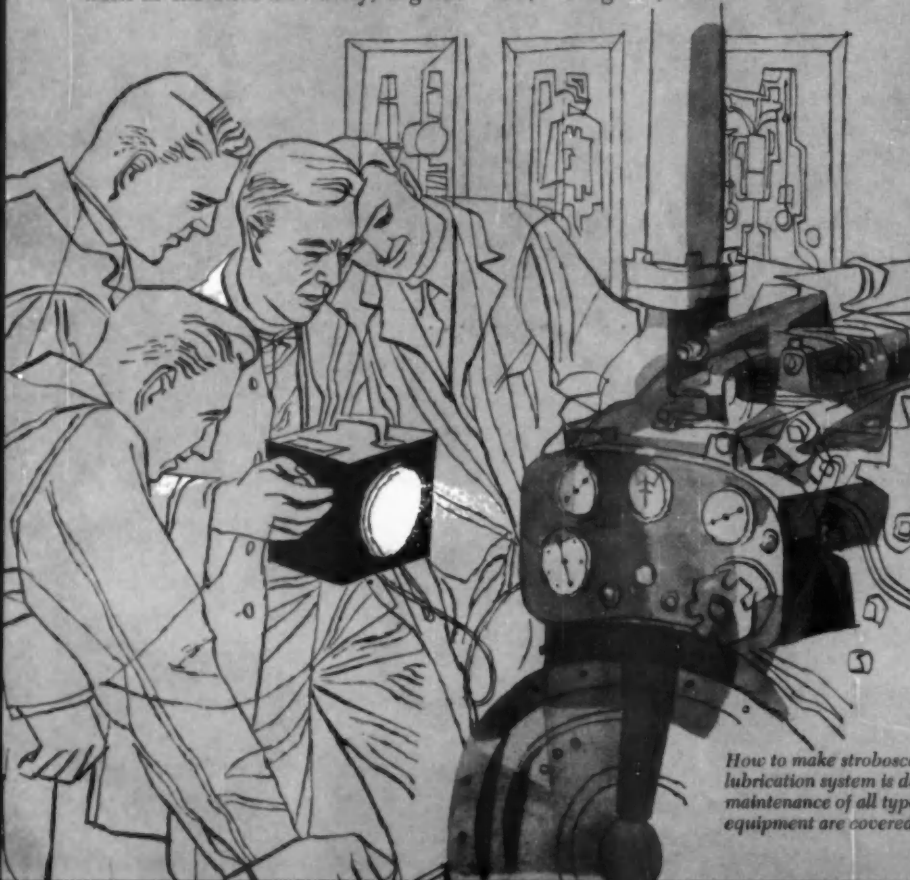


*Testing and comparing bearing  
lubrication methods.*



*Kinematic viscosimeter is used to test  
viscosity of lube oil. C. S. Brown  
(above) learns to run test. Brown, like  
many classmates, has science degree.*

*How to make stroboscopic examination of diesel engine  
lubrication system is demonstrated. Operation and  
maintenance of all types of industrial and automotive  
equipment are covered in curriculum.*





**For dependable power transmission  
under constant, heavy load...**



## **COTTA TRANSMISSIONS**

**serve you better, longer!**

**H**ere's the kind of work Cotta Transmissions are made for: rugged, heavy loads... variable torque conditions... dependable operation required!

This 35 ton Coal Recovery Drill, manufactured by The Salem Tool Company, Salem, Ohio, bores 42" dia. holes into the highwall... breaks up the coal and delivers it to the conveyor at a rate of 400 to 500 tons a day. A mobile power unit rotates the auger and thrusts it 200 feet into the vein. Cotta's Model G2U Heavy-Duty

Transmission provides a reduction in both forward and reverse speeds... meets extreme torque conditions... takes heavy, intermittent shock loads *in stride!*

If you have an application on heavy equipment... cranes, locomotives, drillers, shovels, etc... with input torque from 150 to 2000 foot pounds, Cotta standard or "engineered-to-order" Power Transmissions will serve you better, longer... give you outstanding performance at low cost!

### **THIS INFORMATION WILL HELP YOU**

Diagrams, capacity tables, dimensions and complete specifications sent free on request. Just state your problem—COTTA engineers will help you select the right unit for best performance. May we work with you?

**COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS**



# **COTTA**

**HEAVY-DUTY  
TRANSMISSIONS**

**"Engineered-to-order"**



**Resistant to heat, shock, wear and galling . . .** these nickel cast iron brake drums provide, in addition, extra strength due to their ribbed off-set shape. And the flange rim prevents stretch-

ing of the outer periphery. Increased braking surface lowers pressure per square inch, resulting in cooler, safer operation. Designed and produced by Utility Mfg. Co., Los Angeles, Calif.

## **Nickel cast iron makes good drums better! Last longer...cut operating and maintenance costs**

No problem with fade, overheat, or "bell mouthing" when you use Utility brake drums.

### **Resists Heat Checking and Distortion:**

Utility drums are made of a carefully controlled nickel-molybdenum cast iron to retard heat checking and resist distortion, no matter how long or steep the grade. Specifying 1.75% of nickel assures high strength in an iron able to withstand the intense heat generated on the braking surface.

As a result, users find brake drum life lengthened, while operating and maintenance costs go down sharply.

### **Nickel Prolongs Operating Life**

This is only one of countless examples, showing how the engineering properties of cast iron may be controlled to meet specific needs by use of nickel . . . either alone or along with other alloying elements.

### **If You Have Metal Problems . . .**

If you need special combinations of properties . . . or if machining or heat-treating is a problem . . . we may be able to help you select exactly the right material to meet your needs. Send us details of your difficulty for our suggestions.



**THE INTERNATIONAL NICKEL COMPANY, INC.**

67 Wall Street  
New York 5, N.Y.

# AUTOMOTIVE INDUSTRIES

A CHILTON MAGAZINE PUBLISHED SEMI-MONTHLY

FEBRUARY 1, 1957

VOL. 116, NO. 3

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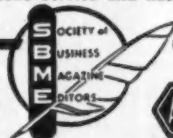
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MEMBER



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**Replaces 4 tools...**

## **Sets nuts 30% faster**

● *Application:* This new *Rotor J-2-L Impact Wrench* with a quick-change chuck does the work of four former tools. By snapping in different adapters, the operator can change quickly from a screw to a bolt or nut. *Result:* 30% faster assembly, less operator fatigue, uniformity of assembly.

Ask for a demonstration or trial of these and other Rotor portable tools to see how they can cut *your* costs! Get Bulletin 41 on the J-2-L. The ROTOR TOOL Company, Cleveland 32, Ohio.

**Here's the Right  
TOOL for YOUR job!**

**Rotor Air Tools:** Assembly Tools • Drills • Small Wheel Grinders  
Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers  
**Rotor High-Cycle Electric Tools:** Grinders • Polishers • Sanders

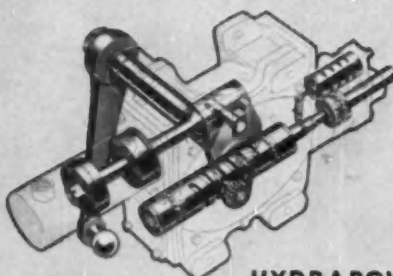




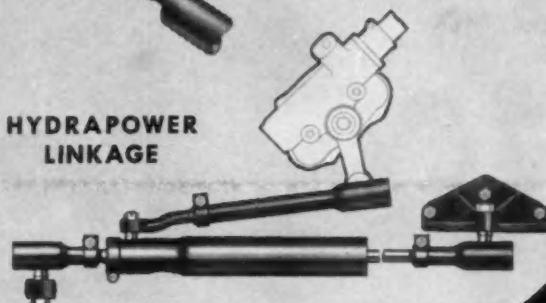
# POWER STEERING



HYDRAPOWER  
SEMI-INTEGRAL



HYDRAPOWER  
INTEGRAL



HYDRAPOWER  
LINKAGE

...ALL 3 TYPES FROM  
1 SOURCE

**Ross**

● For your vehicle, which type of hydraulic power steering will provide maximum steering ease, safety and serviceability at lowest cost?

Semi-Integral? . . . Integral? . . . Linkage?

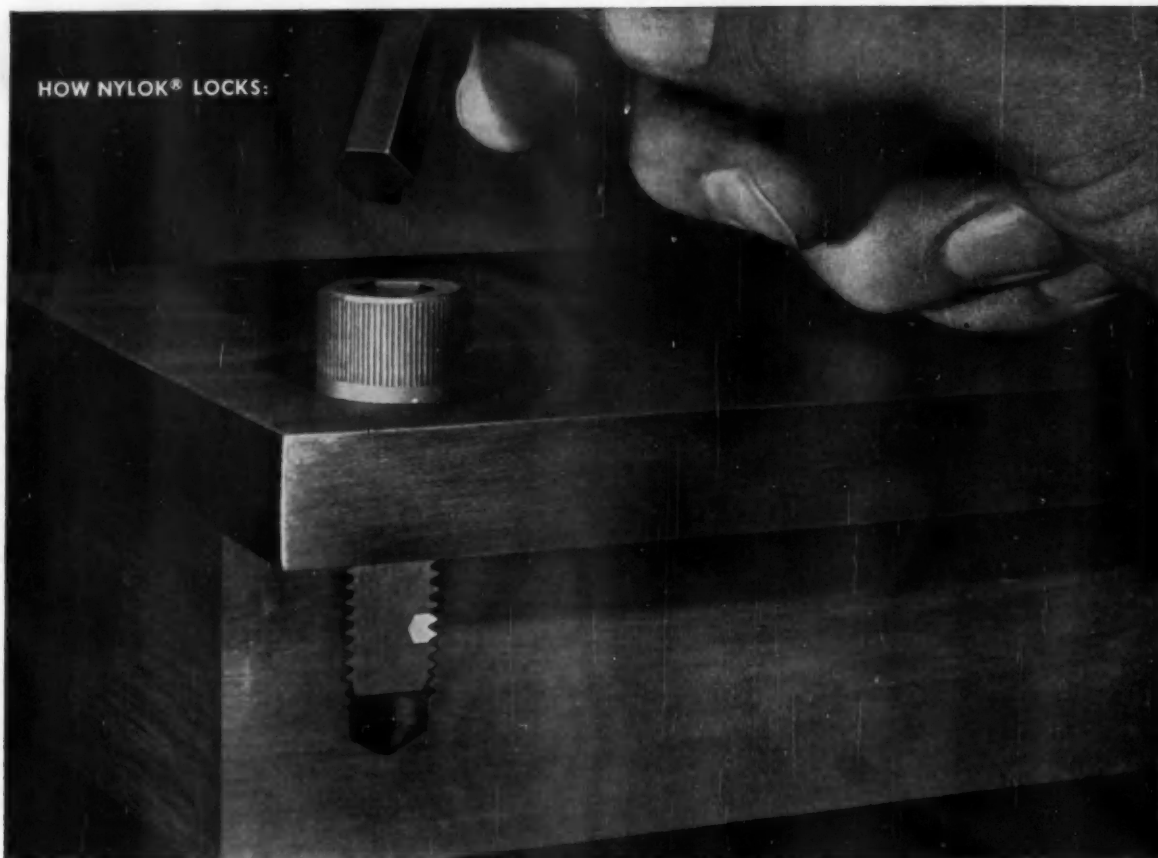
It's a timely question! And one that Ross engineers are prepared to answer in terms of *one* responsibility from design to completed unit—because Ross makes *all three* types, in dependable, effortless, economical *Ross Hydrapower*.

Ross invites discussion of *any* steering problem—manual or power.

ROSS GEAR AND TOOL COMPANY, INC. • LAFAYETTE, INDIANA  
Gemmer Division • Detroit

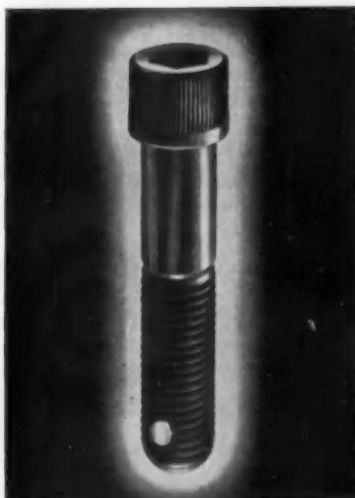
## HYDRAPOWER

HOW NYLOK® LOCKS:



**LOCKED!** The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together and locks the screw securely.

## NEW—self-locking UNBRAKO socket head cap screws



Self-locking UNBRAKO socket head cap screw.

**They won't work loose. And they simplify design and save production time.**

UNBRAKO socket head cap screws are now available embodying the Nylok® self-locking principle. Nylok provides the first truly practical solution to the problem of making cap screws self-locking.

An UNBRAKO cap screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not work loose.

You save production time when you make products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. And in many

cases you will save weight and mass by using shorter screws in tapped holes instead of drilling through and using nuts and lockwashers.

Self-locking UNBRAKOS are reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from  $-70^{\circ}$  to  $250^{\circ}\text{F}$ . And, when screws are properly seated, the locking pellet also functions as a liquid seal.

A complete line of self-locking UNBRAKO socket screw products, in a wide range of standard sizes, materials and finishes, is available through your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 53, Pa.

\*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION

**SPS**  
JENKINTOWN PENNSYLVANIA

AUTOMOTIVE INDUSTRIES, February 1, 1957



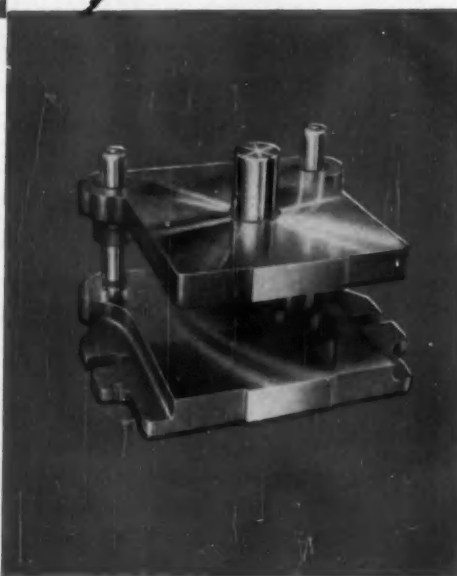
## **NEW** quick change demountable bushings



### ON **NEW** DANLY DIE SETS

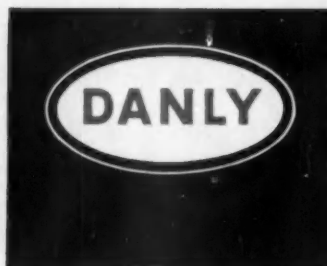
Danly's demountable bushings, a new optional feature, are easily and quickly removed or installed . . . and an ideal companion for Danly's removable guide posts. Check these advantages: first, die maintenance work or grinding is hours faster when posts and bushings can be removed; second, several sets of interchangeable guide posts and bushings can be stocked for any die set to make die set inventory more flexible; third, because no pressing of posts or bushings is involved in assembly, the highest degree of precision is assured. A leading aircraft manufacturer reports that Danly Die Sets equipped with demountable bushings and removable guide posts permitted interchange of guide posts while holding closure accuracy within .0005".

These new demountable bushings provide exceptional resistance to wear, too, especially when used in combination with Danly MICROME chrome plated precision guide posts. No matter what your specific requirements are, you'll find that Danly Die Sets work best for you.



Complete New  
"Leadership Line" Catalog

More than 200 pages provide you  
with complete design information,  
easier selection of die sets and sup-  
plies. Write for your copy today!



**DANLY MACHINE SPECIALTIES, INC.**  
2100 South Laramie Avenue  
Chicago 50, Illinois





## *"...and it's all Stainless Steel"*

That women have long held the nation's purse strings, is a fact with which every marketing man is acquainted. In years past, however, it was considered the man's prerogative to select the family car. But, the market experts will tell you, today women are fast invading this last male stronghold. The new colors and fabrics are direct results of their influence—and, to a great extent, so is the increased use of stainless steel.

The modern woman knows the value of this amazing metal. She has worked with it in her kitchen and is familiar with its resistance to rust and corrosion and she likes the way it stays new for years on end with a minimum of attention. She

wants stainless and discerning designers are catering to her wish.

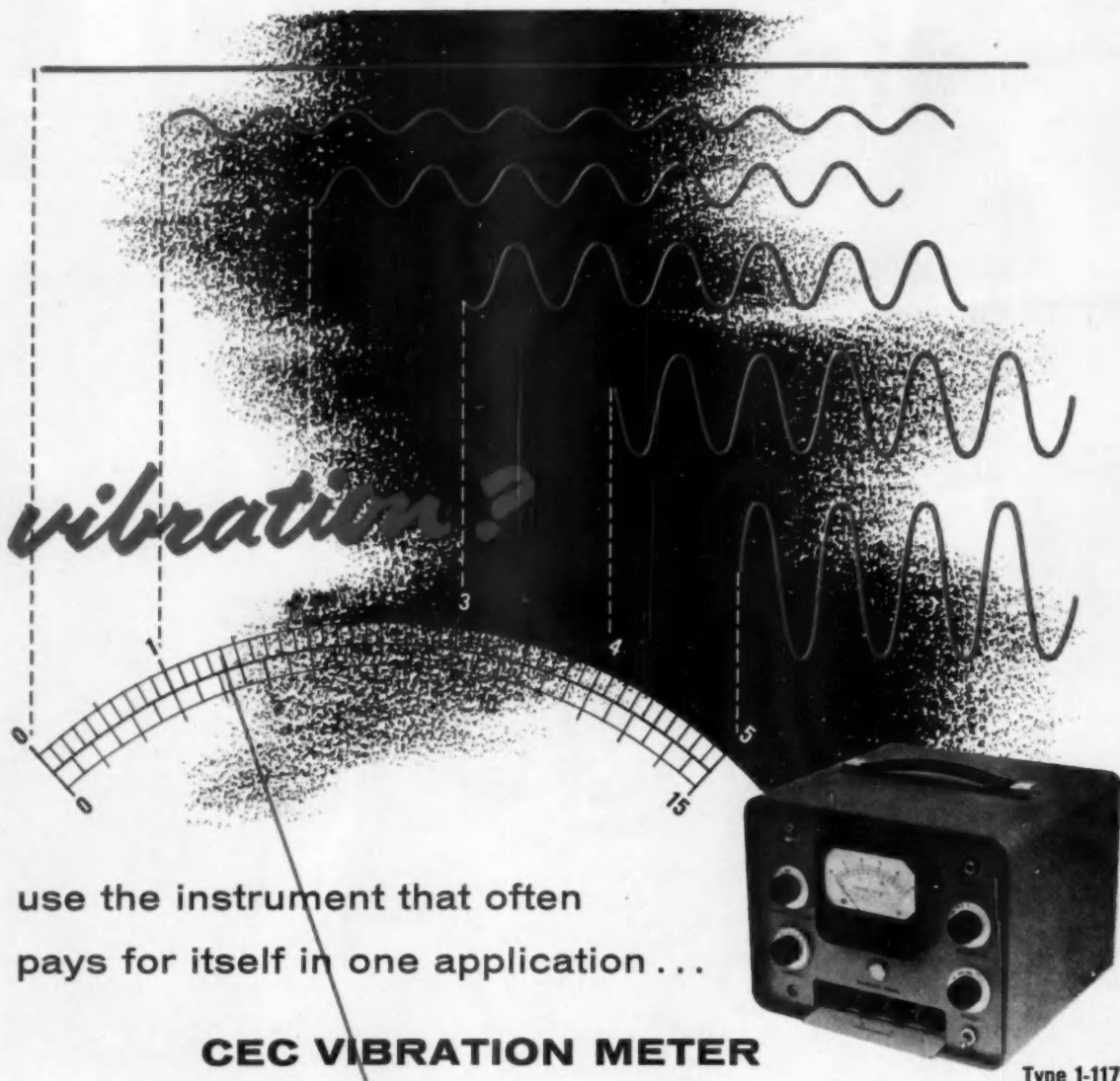
The promise for tomorrow—more and more stainless—much of it from the mills of Sharon where buyers know they can expect consistent quality, plus the industry's finest finish.



### **SHARON STEEL CORPORATION**

SHARON, PENNSYLVANIA

DISTRICT SALES OFFICES: CHICAGO, CINCINNATI, CLEVELAND, DAYTON, DETROIT, GRAND RAPIDS, INDIANAPOLIS, LOS ANGELES, MILWAUKEE, NEW YORK, PHILADELPHIA, ROCHESTER, SAN FRANCISCO, SHARON, SEATTLE, MONTREAL, QUE., TORONTO, ONT.



use the instrument that often  
pays for itself in one application...

## CEC VIBRATION METER

Type 1-117

When control of vibration is critical, CEC's 1-117 Vibration Meter is one of the best investments your company can make. Extremely versatile, accurate and rugged, the portable 1-117 is recommended for any vibration analysis where 115 volt, 50/60/400-cycle a-c is available.

Case histories prove this quality instrument quickly paid for itself many times over in laboratories and jet-engine production and overhaul facilities... more than doubled machine tool life by pinpointing vibration amplitudes of less than 0.0001".

*For complete specifications, please write for Bulletin CEC 1538B-X16, or contact your nearby CEC field office.*

PROVIDES DIRECT READINGS of average velocity and either linear or torsional peak-to-peak displacement on a large, easy-to-read meter. Output may also be connected to an oscilloscope or oscillograph for more detailed wave-form study.

FEATURES 4 INPUT CHANNELS with individually adjustable sensitivity... interchangeable high-pass filters for low-frequency cut-off... highly stable amplifier. The 1-117 is also adaptable to rack mounting. The only external accessories needed are suitably matched, self-generating pickups.

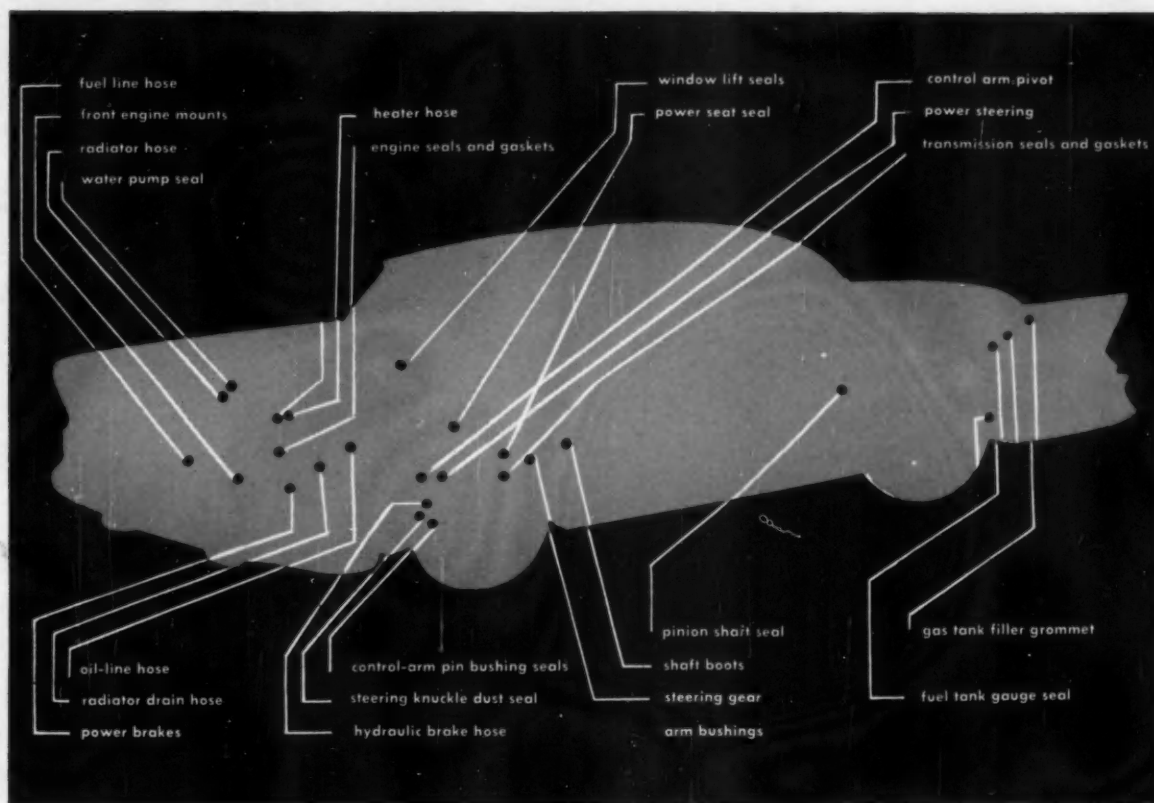
# Consolidated Electrodynamics



300 North Sierra Madre Villa, Pasadena, California

NATIONWIDE COMPANY-OWNED SALES & SERVICE OFFICES

## Naugatuck Paracril



**Paracril...the  
oil-resistant,  
nitrile rubber  
suited to many  
automotive  
applications!**

Spelled-out above are just a few applications for Paracril, Naugatuck's butadiene-acrylonitrile copolymer. Unequaled in resistance to oils, fuels and organic esters, aromatic hydrocarbons, chlorinated organic liquids and most hydraulic fluids, the Paracrils provide greater tensile strength with increased dimensional stability, high abrasive resistance, unusual low-temperature flexibility, and excellent resistance to oxidation.

Paracril® stocks are fully compatible with most other rubbers and plastic resins... can be calendered, extruded, or molded by standard rubber forming methods... are easily dissolved in solvents to make low-viscosity solutions for cement applications.

Why not write to us on your company letterhead for application and test data today?



## Naugatuck Chemical

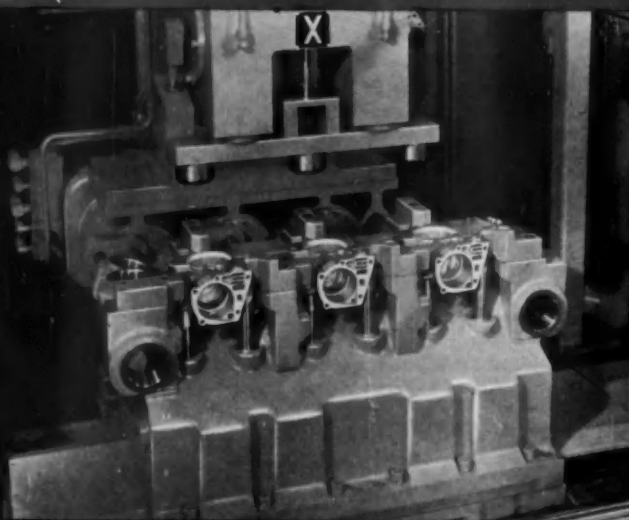
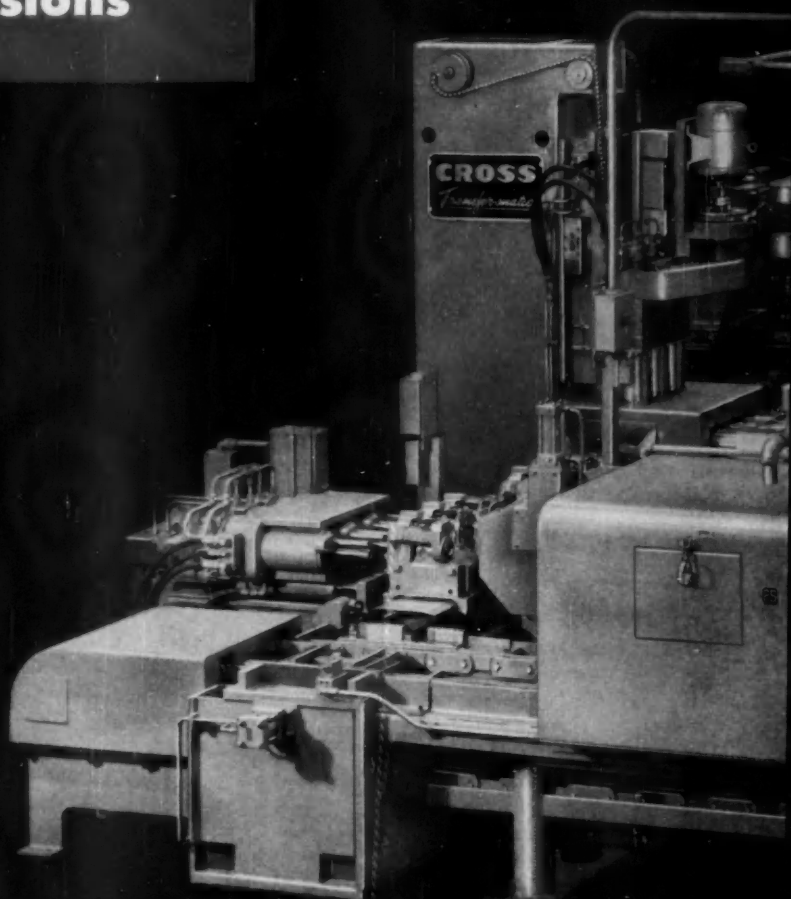
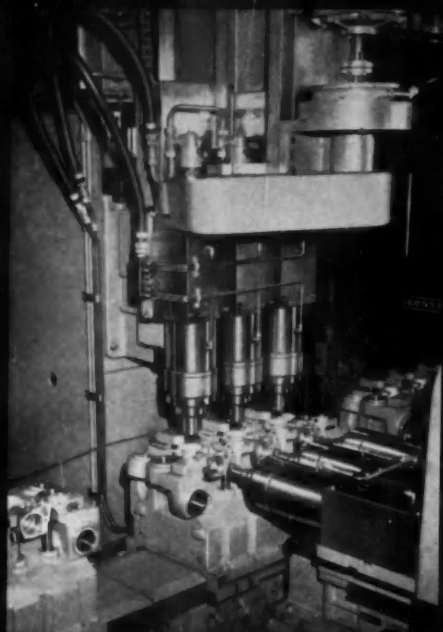
Division of United States Rubber Company  
Naugatuck, Connecticut



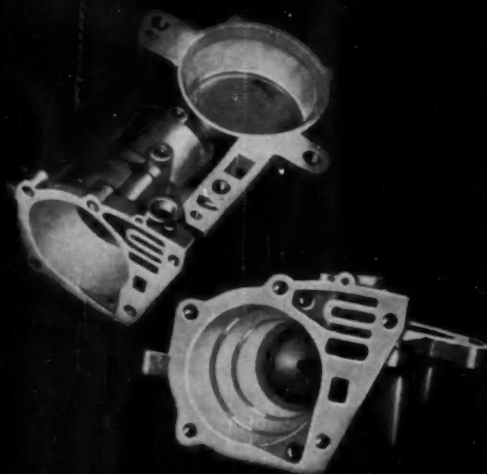
IN CANADA: NAUGATUCK CHEMICALS, Elmira, Ontario • Cable Address: Rubexport, N. Y.  
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latexes

# Completely Machines Servo Valve Bodies for Automatic Transmissions

The final precision boring station.

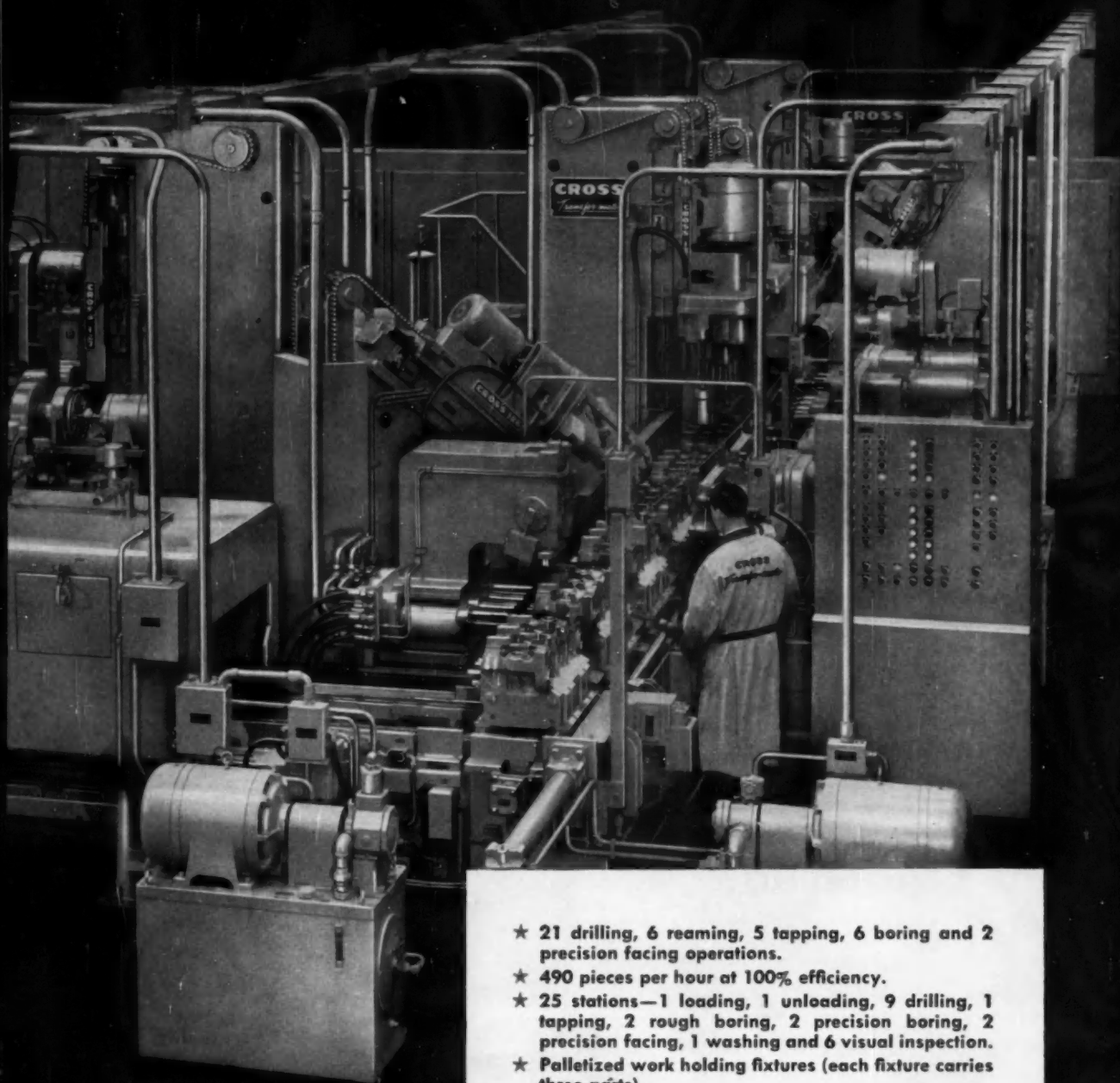


The loading station. Part locations are checked automatically by Unit X to assure proper clamping.





## *Another Transfer-matic by Cross*



- ★ 21 drilling, 6 reaming, 5 tapping, 6 boring and 2 precision facing operations.
- ★ 490 pieces per hour at 100% efficiency.
- ★ 25 stations—1 loading, 1 unloading, 9 drilling, 1 tapping, 2 rough boring, 2 precision boring, 2 precision facing, 1 washing and 6 visual inspection.
- ★ Palletized work holding fixtures (each fixture carries three parts).
- ★ Unloading unit for removing parts from fixtures and placing them on conveyor.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ "Building Block" construction to provide flexibility for design changes.
- ★ Other features: automatic washing unit for fixtures; construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping.

Established 1898

THE

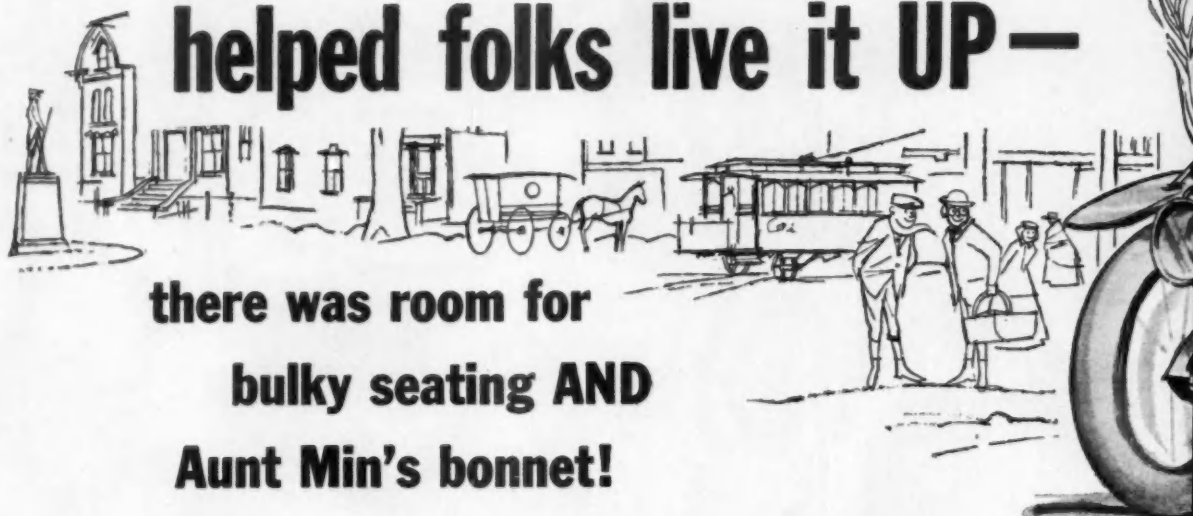
# CROSS

CO.

*First in Automation*

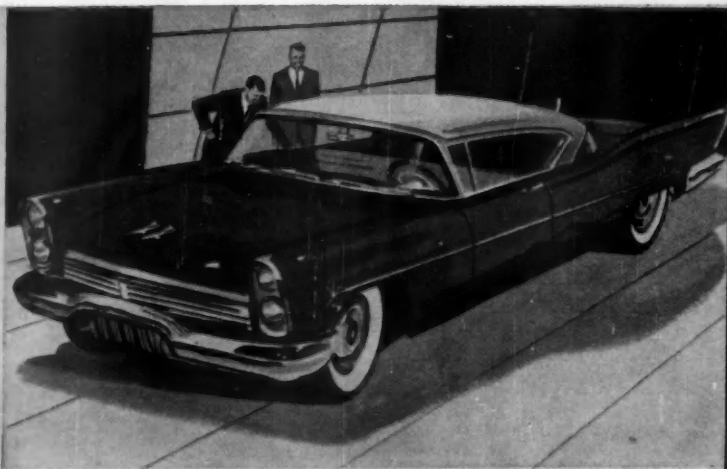
DETROIT 7, MICHIGAN

# When the Mammoth Matheson helped folks live it UP—

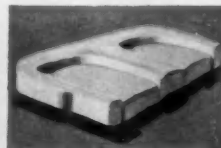


there was room for  
bulky seating AND  
Aunt Min's bonnet!

But today it's  
**How Low**  
Can You Go?



AIRFOAM makes interiors roomier, more luxurious



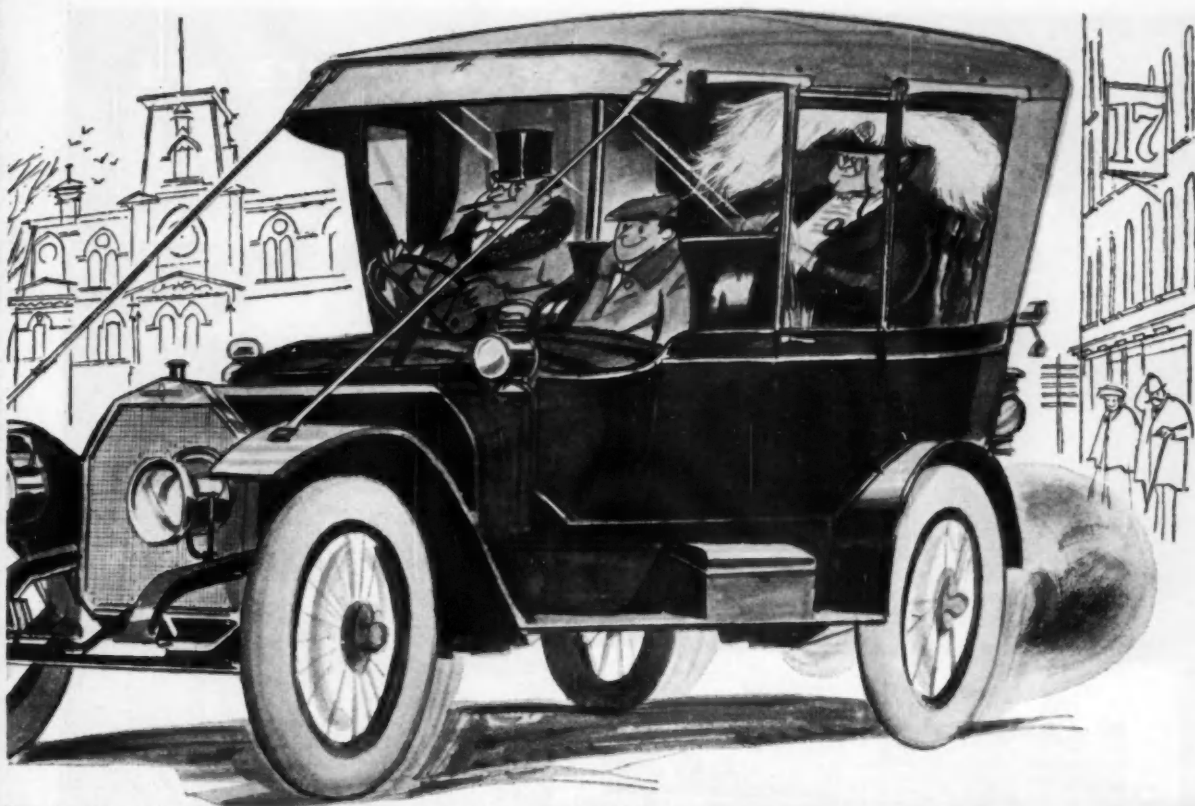
Premolded AIRFOAM replaces expensive handwork—looks even richer



AIRFOAM gives custom looks and custom rides

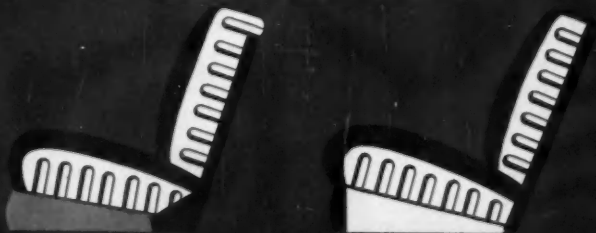
**Airfoam** MADE ONLY BY **GOOD**

THE WORLD'S FINEST, MOST MODERN CUSHIONING



When they go **Airfoam**—  
there's new room  
for comfort and **Sales!**

Cross Section Compares "Old" and  
"New" Seat Construction  
Solid areas indicate space saved  
by full-volume AIRFOAM seat-units.



Airfoam—T.M. The Goodyear Tire & Rubber Company, Akron, Ohio



Exciting new seating ideas become  
practical with AIRFOAM



AIRFOAM can be your  
greatest sales-aid in years

**IT'S GENERALLY AGREED** that the trend to lower styling hasn't hit bottom yet.

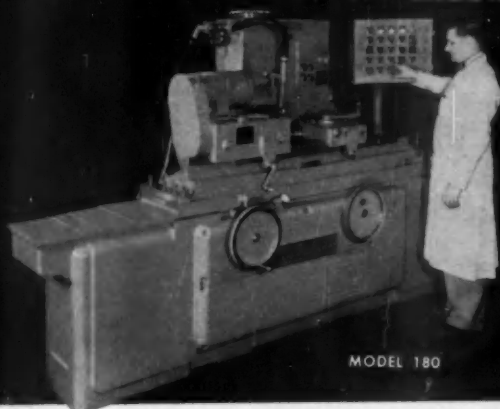
**THIS WILL SPARK YOUR SALES**—unless your designers are still struggling with upholstering methods and materials *simply not suited* to comfort in minimum space.

**WHERE AIRFOAM IS EMPLOYED** as a completely new and different cushioning *medium*—where manufacturers' designers work closely with AIRFOAM Development Engineers—space problems are solved comfortably, beautifully and economically.

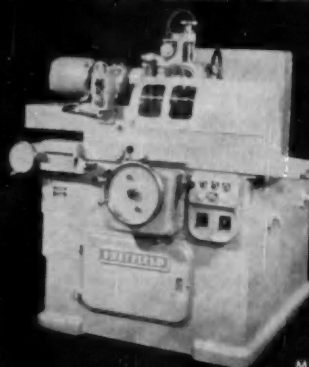
**MAYBE YOUR DESIGNERS** are making the best possible use of AIRFOAM—but the most recent advancements might well be important news. To make sure you know all, contact Goodyear, Automotive Products Dept., Akron 16, Ohio.

**YEAR**

*Grind* **PRECISION FORMS, GROOVES and**  
**LANDS** *in Record Time*  
 with **SHEFFIELD'S** CRUSHTRUE MULTIFORM GRINDERS



MODEL 180



MODEL 109

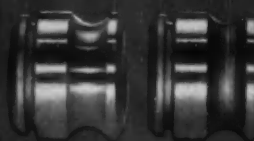


Servo Mechanism Sleeve

The seven grooves of this servo mechanism sleeve are crushtrue ground from the solid to a tolerance of .001" on spacing and .002" on minor diameter in 55 seconds. Material, SAE 52-100; Rockwell, 58-60 C; depth of plunge grind, .145".

Forms and grooves are precision ground on these machines with comparable speed and economy.

For complete details write to Department 4, The Sheffield Corporation, Dayton 1, Ohio, U.S.A.



Bearing Race



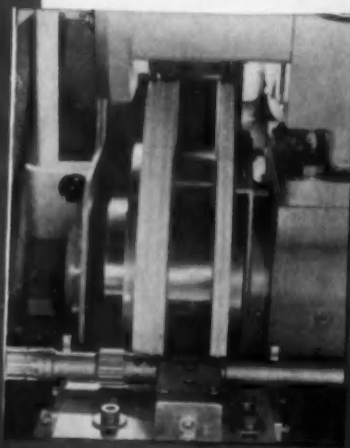
Hydraulic Servo Units



Aircraft Servo Component



Self-aligning Bearings



Grinding Grooves in a Transmission Shaft



Crushtrue Roll



**SHEFFIELD**  
 manufacture and measurement for mankind

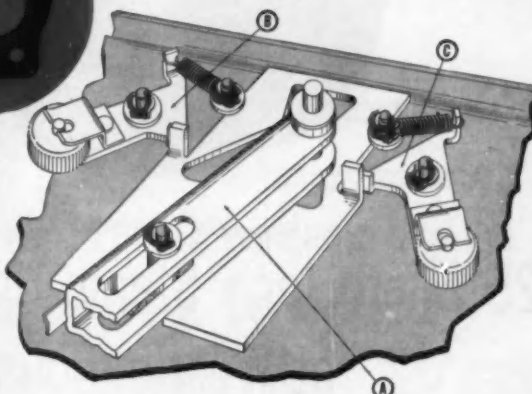
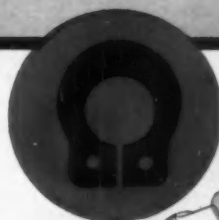


# Waldes Truarc grip rings used on die-cast studs eliminate threading, tapping, other costly machining



Mark Simpson Manufacturing Co., Long Island City, N. Y., uses Waldes Truarc series 5555 Grip Rings to secure parts to studs of the zinc die-cast base of its "Masco 500" portable tape recorder.

The rings—which need no grooves—replace nuts, screws, cotter pins and other types of fastening devices which require threading, tapping, drilling and other expensive machining operations. Because a single cracked or broken stud would render the entire cast base useless—and with it, all assembly completed to that point—the rings also eliminate extremely costly rejects.



**Pivot Assembly** of shift lever (A) is secured by a single Waldes Truarc Grip Ring and washer. Because the washer must be installed over the shift level in a sliding fit, critical tolerances would have to be maintained if a screw or cotter pin were used. The Truarc Grip Ring eliminates that problem: it requires no groove and may be seated over the washer at any point on the stud, automatically compensating for accumulated tolerances in the parts. **BRAKE ASSEMBLIES** (B and C) use Grip Rings to secure the brake wheel and spring sub-assemblies. Here again problems of critical tolerances are avoided and expensive rejects eliminated.

**Whatever you make**, there's a Waldes Truarc Retaining Ring designed to improve your product...to save you material, machining and labor costs. They're quick and easy to assemble and disassemble, and they do a better job of holding parts together. Truarc rings are precision engineered and precision made, quality controlled from raw material to finished ring.

**36 functionally different types**...as many as 97

different sizes within a type...5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U. S. A. and Canada.

**More than 30** engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today...let our Truarc engineers help you solve design, assembly and production problems...without obligation.

For precision internal grooving and undercutting...Waldes Truarc Grooving Tool!



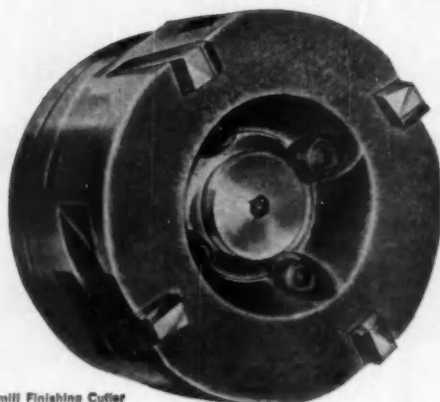
**WALDES**  
**TRUARC**<sup>®</sup>  
**RETAINING RINGS**  
WALDES KOHINOOR, INC.  
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.  
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.  
(Please print)

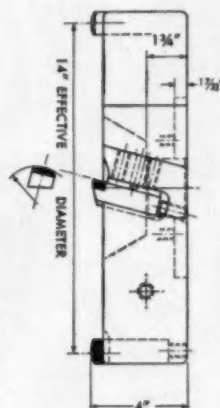
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Company \_\_\_\_\_  
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AY 629

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.



Ingersoll Micromill Finishing Cutter  
28000MM Series...Page 29, Catalog 66



## 25 Micro Inch Steam-Tight Finish at Westinghouse with this **INGERSOLL MILLING CUTTER**

Where finish is important, look to Ingersoll for the answer. There is an Ingersoll cutter to meet virtually every finish requirement. For example, the cutter shown above is being used by Westinghouse, Steam Division, in finish milling high pressure turbine cases.

The cutters used for this work were developed by Ingersoll's research department and proved on Ingersoll's testing floor.

An Ingersoll Cutter Division representative will be glad to discuss this and other finish milling experiences with you.

Whether you are concerned with cutter costs, feed rates, longer tool life, or finish, the new Ingersoll cutter catalog will be a valuable guide. Write for your copy today, address Dept. 66I.



Use this new 82 page guide for selecting the right inserted blade milling and boring cutters for your work. Write for catalog #66, today.

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## CUTTER DIVISION

**THE INGERSOLL MILLING MACHINE COMPANY**

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## **new thermocouple is spring loaded to maintain continuous contact**

This new Honeywell thermocouple keeps in continuous contact with the work surface, even though the surface may expand, contract or become displaced during operation. It assures accurate temperature measurement of internal surfaces such as those of plastic extrusion machines or generator bearings.

The tip of the thermocouple is held securely against the work surface by an *Inconel-X* spring. Moreover, the spring permits insertion of the thermocouple in holes varying up to  $\pm \frac{3}{16}$ " from the specified depth.

For easy inspection and replacement, the thermocouple assembly is provided with a bayonet adapter to fit a  $\frac{1}{8}$ " NPT pipe connection. The assembly itself is fitted with a corresponding cap to engage this adapter.

Call your nearby Honeywell Supplies Man for complete details. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., *Industrial Division*, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.



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**Honeywell**  
BROWN INSTRUMENTS

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Available in either straight or 90° angle construction for ease of installation.

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Modern Crawler tractor design requires a F-L-E-X-I-B-L-E connection between the engine and transmission. MECHANICS Close-Coupled Type UNIVERSAL JOINTS not only provide for high angularity within cramped space but compensate for out-of-alignment conditions. The shocks and strains that crawler tractors encounter in heavy duty work often are so great that they temporarily twist the tractor frame. MECHANICS Close-Coupled Type UNIVERSAL JOINTS are designed to provide the

F-L-E-X-I-B-I-L-I-T-Y needed to make efficient operation possible under such adverse conditions. MECHANICS exclusive KEY method of driving has the highest safety factor, transmits the most torque, and averts costly breakdowns that result from driving through bolts or screws that work loose. Let our engineers show you how these MECHANICS advantages will benefit your product. **MECHANICS UNIVERSAL JOINT DIVISION**  
Borg-Warner • 2024 Harrison Ave., Rockford, Ill.

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## UNIVERSAL JOINTS

For Cars • Trucks • Tractors • Farm Implements • Road Machinery •  
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engineering progress



For forty-seven years McQuay-Norris has helped automotive designers convert ideas into reality.

For ring design service that always measures up to your needs, call on us.



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MANUFACTURING COMPANY

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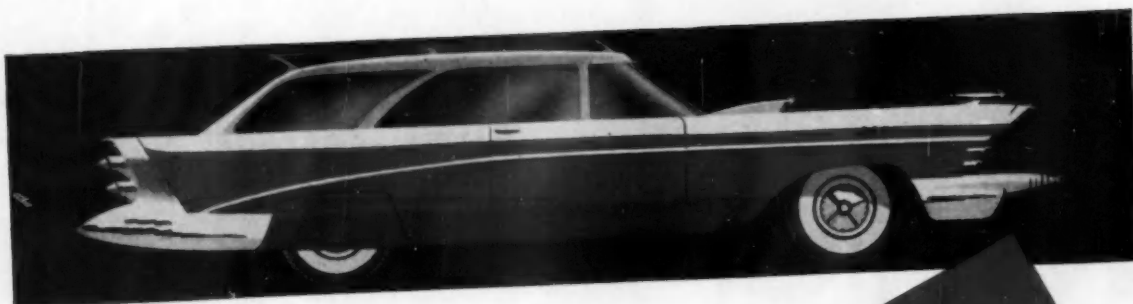
*Largest Producer of Small Rings in the Automotive Industry*

# CLEVELAND

## ...In Step With The Modern Trend

**Universal Joints,  
Propeller Shafts and  
Power Take-Off Joints**

New, more powerful engines, lower silhouette designs and smaller clearances of today's motor vehicles demand a new type of propeller shaft. It takes a plenty rugged assembly of much higher capacity, capable of working in a much smaller radius, to meet today's exacting requirements.



Having anticipated this trend to super power and super sleekness, "Cleveland" is ready with many new series of propeller shafts. These have greatly *increased* strength and *decreased* swing diameter and also incorporate the many advantages of the celebrated 32 tooth conventional spline shaft pioneered by "Cleveland".



Look to "Cleveland" for propeller shaft and universal joint requirements. We'll welcome the opportunity to work with you.

**Since 1912**  
**Cleveland Steel Products Corporation**  
**Automotive Division**

**16025 Brookpark Road  
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**CTW**



Continental Counterbores may be purchased individually or in sets. Selection of three sets available.



## After the heaviest cuts— they disengage with a twist of the wrist

Continental Counterbores are designed so that cutting torque produces compression rather than shearing stresses. This counterbore never binds—you get quick, easy disengagement after all cutting operations. Anti-wedging action saves time and tools.

Continental Counterbores have double driving lugs on the cutters which engage double abutments in the holders, making a single powerful tool out of the cutter and holder. Double bearings, one above and one below the lugs and close to the cutting edge, guarantee rigid alignment of holder and cutter.

For more information or literature on Continental Counterbores, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit.

**Continental** **TOOL WORKS**

DIVISION OF  
EX-CELL-O CORPORATION • DETROIT 32, MICHIGAN

56-61

# Inside story of the most



1

Every brake cylinder is checked underwater for leaks.

5

Final closure and pressure test is made at this press.



# famous brake in the world

Even schoolboys know the fabulous story of George Westinghouse, and how he accelerated developments of railroad transportation with his Westinghouse Automatic Air Brake. Even if a train breaks in two, brakes are applied to *each* section to stop it.

Although Westinghouse Air Brake Company has made countless improvements in braking devices, the basic operating principles have prevailed since 1872. Original design of some parts is still followed today, that's how well they were designed

in the first place.

A good example is the release spring, which retracts the brake cylinder piston when the brakes are released. American Steel & Wire has been supplying this spring for about 75 years. And although better steels and heat treatment are always being used, this original spring design has been operating over a 160° F. tem-

perature range, stressed hundreds of times monthly, and is currently in service on over 2 million freight cars all over the world.

We are proud of our long association with Westinghouse Air Brake Company, maker of the most famous brake in the world, considered by many people to be one of the great inventions of our time.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO  
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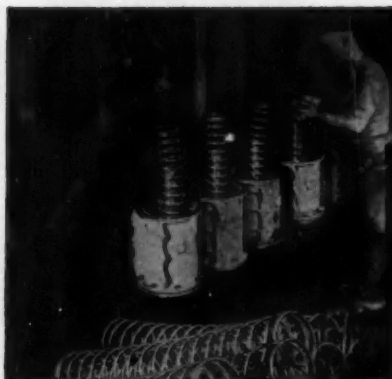
## USS AMERICAN QUALITY SPRINGS



**2** Piston assembly. Westinghouse Air Brake Company makes its own rubber parts.



**3** After piston is inserted, workman lubricates the cylinder.



**4** Spring inserting. The housing is machined high-density cast iron.



**6** Cylinder at left is for freight cars, other is one of several used on a locomotive.



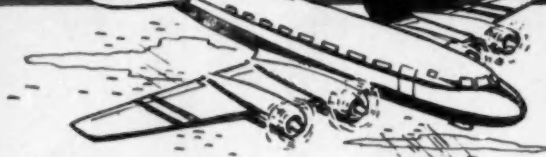
**7** In position. Cylinders go three years between cleanings.



UNITED STATES STEEL



## There's no substitute for the **FORGED** crankshaft



Crankshafts have been made successfully by other methods of fabrication and have proven to be good enough for certain non-critical applications—but for maximum dependability of the modern, compact, high compression, high torque engine a forged crankshaft is essential.

The forging process assures, to the greatest degree possible, uniformity and predictability of physical properties with a minimum variance from piece to piece or from one location to another in the same piece.



Wyman-Gordon has been forging crankshafts since the beginning of the internal combustion engine era and today produces more crankshafts for a greater variety of applications than any other company in the world. In a crankshaft there is no substitute for a forging, and in a forging there is no substitute for Wyman-Gordon quality and experience.

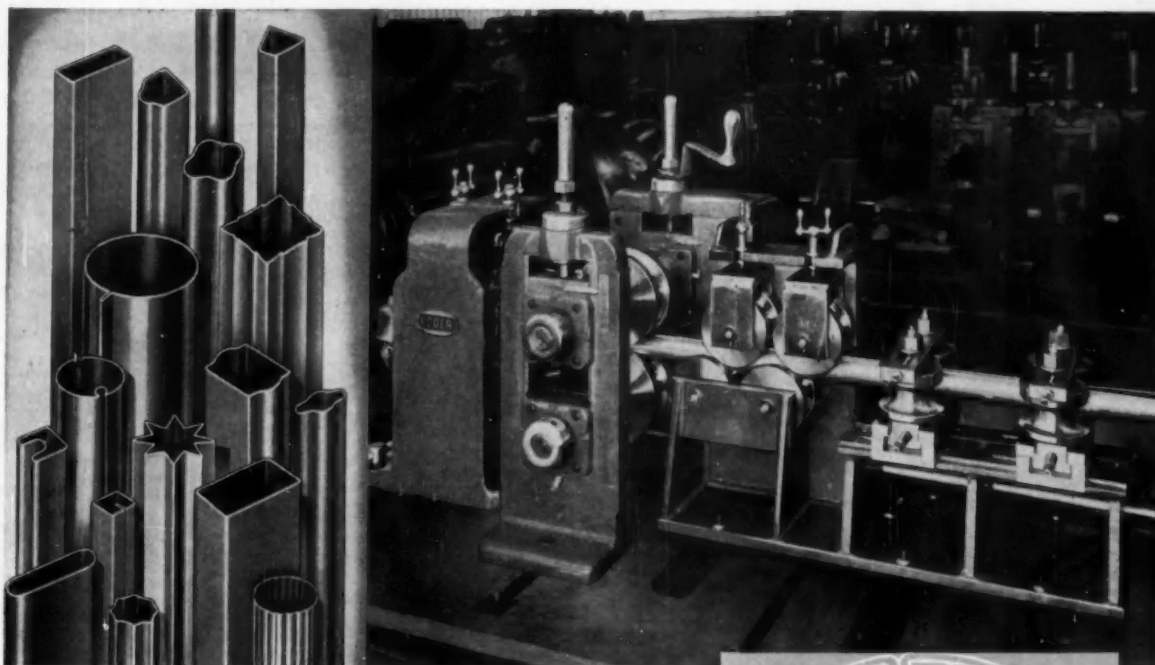
# WYMAN-GORDON COMPANY

Established 1883

WORCESTER 1, MASSACHUSETTS

HARVEY, ILLINOIS • DETROIT, MICHIGAN

FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM



*Lock-Seaming attachment at exit end of forming machine.*

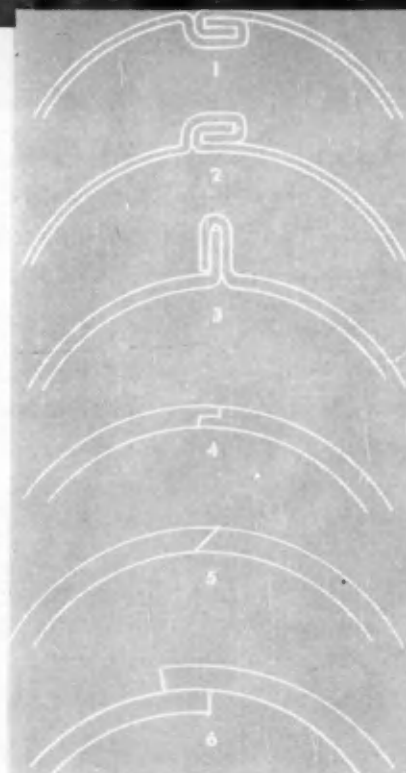
## COLD ROLL FORMING TUBULAR SHAPES

Among the wide variety of things you can make on a Yoder Cold Roll Forming machine are round, square, oval, rectangular and other tubular shapes, such as illustrated at left above. The seams may be open, lapped, butted, dovetailed, interlocking, etc.—as indicated in Figures 1 to 6 at the right.

Millions of feet of such unwelded tubular shapes are made from coiled strip for conductor pipe, bedsteads, lamp stands, window channel, wiring raceways, carrying rods, etc. Production ranges from 20,000 to 50,000 feet per day, with only one operator and a helper.

Yoder offers you the cooperation of their engineering staff for designing and adapting their cold roll forming machines, auxiliaries, and tooling, for the low cost production of structurals, mouldings and trim, panels, tubular and other shapes, to meet individual needs.

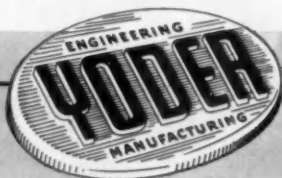
The Yoder book on Cold Roll Forming is a complete, illustrated text on the art and the equipment needed for performing a variety of operations which can be combined with cold roll forming, at little or no extra labor cost. A copy is yours for the asking.



### THE YODER COMPANY

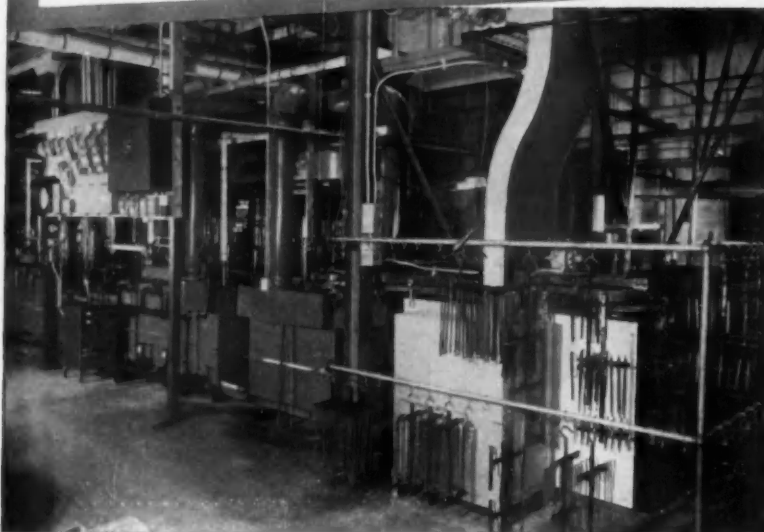
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**COLD ROLL FORMING MACHINES**  
**ROTARY SLITTING LINES**  
**PIPE AND TUBE MILLS—Electric Weld**

## A BRIGHT FUTURE IN MUSIC STANDS WITH UDYLITE HI-C BRIGHT NICKEL



Krauth and Benninghofen, of Hamilton, Ohio, has been making music stands for almost a hundred years. Now a third generation continues the operations making about 99 percent of all the music stands sold in the United States.

Last year Udylite Bright Nickel 514H, the high chloride, high speed process, with a bright chrome overlay replaced the single step gray nickel which had long been the standard music stand finish. The sales appeal of the bright nickel bright chrome finish forced higher production to meet the 20 per cent sales increase.

The operation of a Udylite high production Full Automatic Plating Machine enables these people to apply the new double process finish with precision and to get this better appearance and better corrosion resistance *at lower unit cost.*

Update *your* finish, *your* production and *your* costs with all of the advantages of Udylite Processes and Equipment.



WORLD'S LARGEST  
PLATING SUPPLIER

## CALENDAR

### OF COMING SHOWS AND MEETINGS

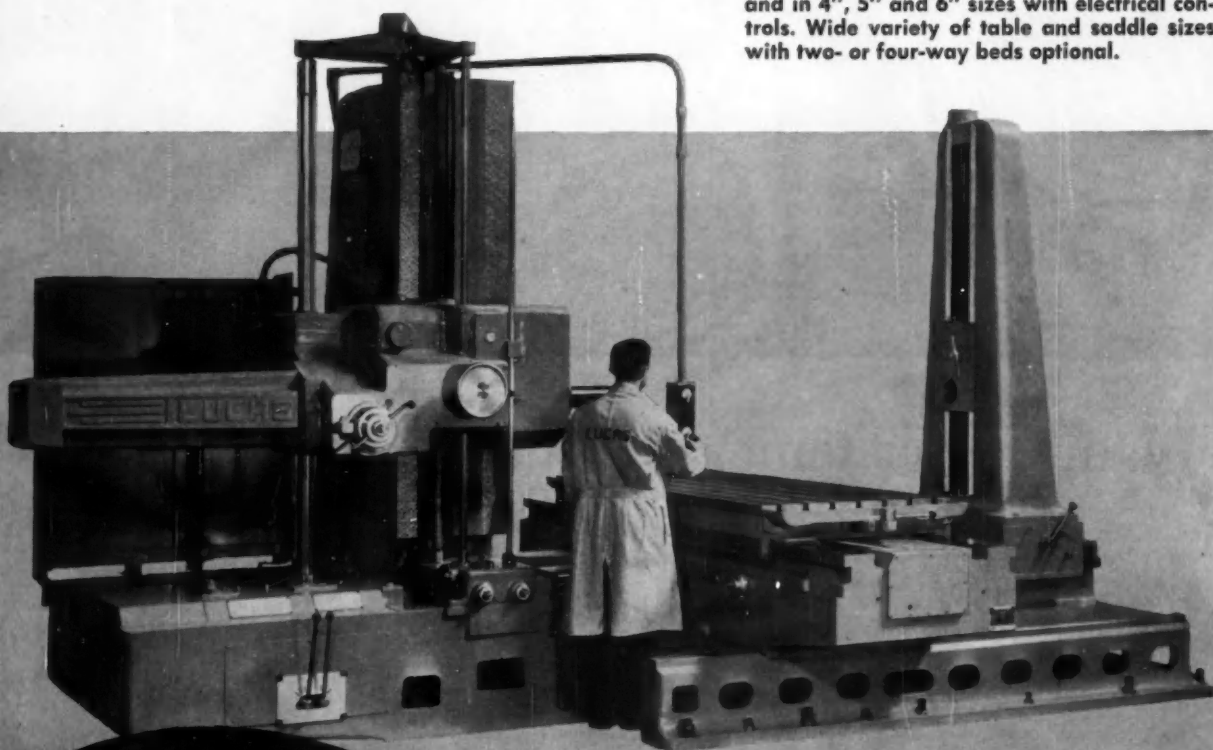
- American Management Association, annual marketing conference, Hotel Statler, New York, N. Y. ....Feb. 4-6
- Automotive Accessories Manufacturers of America, exposition, Coliseum, New York, N. Y....Feb. 4-7
- American Society for Testing Materials, spring meeting, Benjamin Franklin Hotel, Philadelphia, Pa. ....Feb. 4-8
- Society of the Plastics Industry, 12th annual Reinforced Plastics Div. Conference, Edgewater Beach Hotel, Chicago, Ill....Feb. 5-7
- American Management Association, conference on nucleonics in industry, Statler Hotel, New York, N. Y. ....Feb. 7-8
- American Management Association, annual electronics conference, Hotel Statler, New York, N. Y. ....Feb. 25-27
- Western Joint Computer Conference, Statler Hotel, Los Angeles, Calif. ....Feb. 26-28
- Leipzig Fair, Germany .....Mar. 3-14
- SAE National Passenger Car, Body, and Materials Meeting, Sheraton-Cadillac Hotel, Detroit, Mich. ....Mar. 5-7
- Pressed Metal Institute, annual spring technical meeting, Hotel Carter, Cleveland, O. ....Mar. 6-8
- Pacific Automotive Show, Civic Auditorium, Seattle, Wash. ....Mar. 7-10
- Atomic Exposition and Nuclear Congress, Convention Hall, Philadelphia, Pa. ....Mar. 11-15
- National Industrial Conference Board, fifth conference on Atomic Energy, Philadelphia, Pa. ....Mar. 14-15
- Geneva Automobile Show, Switzerland .....Mar. 14-24
- Society of the Plastics Industry, annual national conference and Pacific Coast plastics exposition, Los Angeles, Calif. ....Mar. 18-21
- ASME Gas Turbine Power Conference, Sheraton-Cadillac Hotel, Detroit, Mich. ....Mar. 18-21
- Military Automation Exposition, Trade Show Bldg., New York, N. Y. ....Mar. 18-21
- SAE National Production Meeting and Forum, Hotel Statler, Buffalo, N. Y. ....Mar. 20-22
- American Society of Tool Engineers, silver anniversary technical meeting and convention, Shamrock Hilton Hotel, Houston, Tex. ....Mar. 25-27
- Western Metal Congress and Exposition, Los Angeles, Calif. ....Mar. 25-29
- ASME Engineering Management Conference, William Penn Hotel, Pittsburgh, Pa. ....Mar. 27-28
- SAE National Aeronautic Meeting, Production Forum, and Engineering Display, Hotel Commodore, New York, N. Y. ....Apr. 2-5
- ASME Spring Meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala. ....Apr. 8-10
- National Packaging Exposition and Conference, Chicago, Ill....Apr. 8-11
- American Welding Society, national spring meeting and fifth welding and allied industry exposition, Philadelphia, Pa. ....Apr. 8-12
- Materials Handling Exposition and Conference, Philadelphia, Pa. ....Apr. 29-May 3



# there's always work for a Lucas

Extreme accuracy, feather-touch pendant control, automatic power positioning for repetitive work make a Lucas the most useful machine in any shop. There's a model and size for *your* horizontal boring, drilling and milling operations. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

A complete range of models, built in 3", 4" and 5" spindle sizes with mechanical controls and in 4", 5" and 6" sizes with electrical controls. Wide variety of table and saddle sizes with two- or four-way beds optional.



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# FORESIGHT



## Planning for tomorrow • Producing for today!

Since the earliest days of the industry, Bendix foresight in product design and development has contributed materially to automotive progress.

For example, Bendix\* power braking and power steering, two of the industry's most popular new car features, are the results of years of research and engineering by Bendix specialists in these important fields.

Today Bendix engineers are likewise busy planning

and developing new and better products to meet the needs of the years ahead.

It is because of this foresight the automotive industry looks to Bendix for components that continue to lead in public acceptance and dependable performance.

\*REG. U.S. PAT. OFF.

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**TYPICAL  
EXAMPLES**



Bendix Power Brakes



Bendix Power Steering

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## High Spots of This Issue

### ★ Axle Shafts Machined on New Equipment at Cadillac

A compact, self-contained process line with a variety of new equipment is facilitating the production of flanged rear axle shafts for 1957 Cadillacs. Detailed here are the step-by-step operations that take place in the work cycle. Page 46.

### ★ New Truck Models Introduced by Ford

Lower overall height and reduced cab and front end length characterize the Ford truck line for 1957, which includes a new tilt-cab model. Four basic power plants with nine modifications are available, and horsepower is up. Page 49.

### ★ Advanced Transfer Machine for Main Bearing Sets

Recently installed by Chrysler Div. in its East Jefferson engine plant is a highly advanced and compact transfer machine for main bearing sets. Designed and built by LaSalle, it incorporates a number of interesting features. Page 54.

### ★ Automatic Machines at Oldsmobile

Many important developments are in the making at the Oldsmobile engine plant. Among the noteworthy are automatic assembly machines and an automated process line for machining of cast camshafts without operator attention. Page 56.

### ★ Annual Meeting of the SAE

Fuel injection systems and nuclear power plants, plus a host of other vital topics, were subjects of the 61 papers given in 24 technical sessions at the SAE meeting last month. Many other activities were also included in the program. Page 60.

### ★ 32 New Product Items And Other High Spots, Such As:

Opel plant; Packard; Lucas fuel injection system; milling and turning stem pinions; Continental Diesel; and TV Views Welds.

*Complete Table of Contents, Page 3*  
*Automotive and Aviation News, Page 33*

AUTOMOTIVE INDUSTRIES COVERS  
PASSENGER CARS • TRUCKS • BUSES • AIRCRAFT • TRACTORS • ENGINES  
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# Cincinnati Combines Quality Control and Production Control for Your Precision Centertype Grinding



Every shop wants closer control of quality and production. It's especially desirable for final operations, when cost per unit nears its maximum. In the field of precision centertype grinding on 6" to 14" machines, Cincinnati's standard and extra features combine quality control and production control into a unified, automatic function of the machine.

The cost-control features illustrated at the right, and many others are outlined in two attractive catalogs: No. G-660-1 for the CINCINNATI® FILMATIC 6"R and 10"R Plain Hydraulic Grinding Machines. No. G-661 for the 10"R and 14"R Machines. Write for copies, or look in Sweet's for brief specifications.

## CINCINNATI GRINDERS INCORPORATED CINCINNATI 9, OHIO

Members of this family group of CINCINNATI FILMATIC Plain Hydraulic Grinders are:

Size	Between-Center Lengths	Catalog
6"R }		
10"R }	18" and 30"	G-660-1
10"R }	18", 36", 48"	
14"R }	72" and 96"	G-661

# CINCINNATI

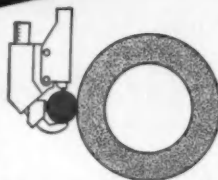
CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE • GRINDING MACHINES • CHUCKING GRINDERS  
MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES



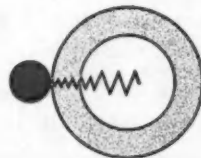
FILMATIC Grinding Wheel Spindle Bearings and Grinding Wheel Balancing are standard equipment. (FILMATIC principle illustrated above.) These two cost-reducing features alone are reason enough to choose CINCINNATI.



**CINCINNATI FILMATIC**  
**6"R x 18"**  
**Plain Hydraulic Grinding Machine**  
Equipped with Quality Control  
and Production Control



Automatic Air-Electric Gage Sizing (extra) includes an exclusive CINCINNATI advantage . . . cycle time stabilizer for wheel wear and truing.



Gap Eliminator . . . greatly reduces time spent in "cutting air" during automatic infeed grinding operations. (extra)





# News of the AUTOMOTIVE AND AVIATION INDUSTRIES

Vol. 116, No. 3

February 1, 1957

## **Chevrolet Introduces Chassis For Multi-Stop Delivery Field**

Chevrolet is starting production this month on two new two-ton truck chassis designed particularly for the expanding heavy-duty multi-stop delivery field. The new models are forward control chassis with a gross vehicle weight range of 14,000 to 18,000 lb, depending upon optional tires and front axles. A wide tread 7000-lb axle is mandatory with the 18,000-lb GVW rating. The 148-hp Jobmaster 261 six-cylinder engine is standard equipment.

One model with a 129-in. wheelbase is suitable for installation of either single unit bodies or bodies behind cabs with a loading space of up to 12 ft. The other with a 153-in. wheelbase accommodates a 14-ft body.

Other features are: 30-gal gasoline tank, special arrangement of chassis components to allow many variations in body design, and optional generators, batteries, tires, and axles for extra heavy-duty work.

The company also announced that the top capacity of Chevrolet trucks for 1957 has been increased to a new high of 36,000 lb GVW. The upward revision from a previous high of 32,000 lb covers the three heaviest-duty models, three optional two-ton tandems.

## **Ford and Chrysler Increased Output Percentage in January**

While it is still much too early to draw any real conclusions, the car production pie thus far this year is being cut up a bit differently from the same time a year ago.

During the first three weeks of 1957, General Motors had 47.6 per cent of total production, a drop of nearly five percentage points under a year ago. Ford's share jumped up more than five points to 30.08 per cent. Chrysler carved out 18.7 per



*Chevrolet two-ton truck chassis designed for multi-stop delivery operations.*

cent, compared with 17 per cent a year ago.

American Motors fell off from 2.2 per cent last year to 1.4 per cent this year. Studebaker-Packard declined from 2.9 per cent to 1.2 per cent.

## **GM Delays Construction On Two Assembly Plants**

General Motors temporarily has put the brakes on its plant expansion program. Construction is being delayed on at least two plants. They include a 1.2 million sq ft B-O-P assembly plant near San Francisco, for which grading was to start soon and a Chevrolet plant at Lordstown, Ohio, on which construction has been delayed for the second time.

The delays should not affect much the company's capital expenditures in 1957. GM outlays for tooling and facilities this year should still total about \$1.25 billion. It is estimated that GM spent \$1.63 billion in 1956 for capital investment and new tooling.

## **Ford Joins Chrysler, GM In Scrapping Ad Program**

The dealer co-operative advertising program is dead as far as the Big Three car companies are concerned. Ford last month joined Chrysler and General Motors in scrapping the program.

Under the plan, car dealers were required to contribute varying amounts into a co-operative fund for national and local advertising. Such costs, estimated at about \$20 per car, will now be added to the wholesale prices of cars. This automatically increases the suggested retail price by approximately \$8. Whether the increase will be passed on to buyers will depend on individual dealers.

## **Reo Gets \$3½ Million Engine Order From S-P**

Reo has bolstered its truck business with a \$3½ million order for engines to be used by Studebaker-Packard in military trucks. Deliveries of the V-8 engine are to be spread through 1957.

# News of the AUTOMOTIVE

## 1956 RETAIL CAR SALES BY PRICE GROUPS\*

Price Group	November				Eleven Months			
	1956		1955		1956		1955	
	Units†	% of Total	Units†	% of Total	Units†	% of Total	Units†	% of Total
Under \$2,000	13,514	3.42	90,176	17.09	844,905	15.77	3,261,732	50.14
\$2,001 to \$2,500	281,409	66.06	346,951	68.64	3,045,279	56.82	2,386,533	36.46
\$2,501 to \$3,500	100,641	25.44	45,083	8.94	1,246,539	23.32	687,429	10.50
Over \$3,500	20,092	5.08	21,842	4.33	216,962	4.09	109,673	2.90
Total	395,656	100.00	504,052	100.00	5,353,795	100.00	6,545,367	100.00

## Dollar Volume of Sales

Price Group	November				Eleven Months			
	1956		1955		1956		1955	
	Dollars	% of Total	Dollars	% of Total	Dollars	% of Total	Dollars	% of Total
Under \$2,000	\$ 26,324,980	2.78	\$174,075,960	15.07	\$1,654,004,062	13.18	\$6,230,503,683	42.16
\$2,001 to \$2,500	661,484,816	59.30	738,834,153	65.69	6,549,363,728	52.09	5,438,331,464	38.63
\$2,501 to \$3,500	277,006,453	29.34	131,948,918	11.41	3,437,092,302	27.33	1,943,450,284	13.47
Over \$3,500	81,205,572	8.58	96,405,030	7.83	834,060,624	7.43	770,339,967	6.34
Total	\$946,021,821	100.00	\$1,155,167,063	100.00	\$12,574,460,706	100.00	\$14,432,625,398	100.00

\*—Calculated on basis of new car registrations, as reported by R. L. Polk & Co., in conjunction with advertised delivered price at factory of four door sedan or equivalent model. Does not include transportation charges or extra equipment.

†—New registrations of American made cars only. Does not include imported foreign cars.

## Reductions in Steel Buying Confined To Few Car Makers

A report in a national financial publication that automobile companies are making noticeable cutbacks in buying steel needs clarification. A check among the leading car companies reveals that only a few of the makers, particularly those which have trimmed car output schedules, are planning to reduce steel buying.

Most of the reductions are scheduled for March. The cutbacks pose no immediate threats to the present high rate of steel production. It has been stimulated by heavy demand in other industries.

## Ford Manufacturing Setup Split Into Six Divisions

In order to expand its manufacturing organization, Ford Motor Co. has separated three existing divisions into six. Three new group vice presidents, four new group executives, and eight new division general managers have been appointed.

The present Parts and Equipment Div. has been separated into individual Hardware and Accessories divisions; the Metal Stamping Div. was made into a new Frame-Tool and Die Div. and new Stamping Div.; and

the Engine and Foundry Div. was split into separate Engine and Foundry divisions.

Named to the new group vice-president posts were Ray H. Sullivan, John Dykstra, and Irving R. Duffy. All three will report directly to Del S. Harder, executive vice-president of the manufacturing divisions.

The four new group executives include J. S. French, who will be responsible for the new Hardware and Accessories divisions; A. J. Hole, responsible for the new Frame-Tool and Die Div. and new Stamping Div.; C. H. Patterson, responsible for the new Engine and Foundry divisions; and M. L. Katke, responsible for the new Automatic Transmission Div. and the Chassis Parts Div. K. D. Cassidy continues as group executive—general products. He has responsibility for the Steel, General Products and Manufacturing Services divisions.

The eight new general managers and the divisions they will head include: Merritt D. Hill, Implement; J. B. Lawson, Automatic Transmission; R. H. Ponta, Engine; F. X. Bujold, Foundry; A. C. Haines, Frame-Tool and Die; S. S. Wilson, Stamping; W. F. Mueller, Hardware; and P. A. Miller, Accessory. General managers of other basic manufacturing divisions retain their positions.

## GM's New Brazilian Foundry Provides For Future Growth

General Motors will build a new foundry for its General Motors do Brasil subsidiary near Sao Paulo, Brazil. Design will be similar to GM's foundries in the U. S. It will incorporate many modern production techniques developed by the Central Foundry Div. over the past several years. Actual design of the 20,000 sq ft unit will be similar to the corporation's foundry at Defiance, O.

Careful consideration has been given to providing adequate capacity for possible future expansion. Initially, the plant will turn out six-cylinder engine blocks for a truck similar to the Chevrolet and other grey iron malleable iron castings. Future plans call for production of castings for a wider range of trucks and buses which GM expects to produce in Brazil.

Production departments will include melting, core-making, foundry, annealing and finishing. Because of the high cost of coke for cupola melting, the initial melting installation will consist of two large electric furnaces for melting raw materials and two holding furnaces.

The foundry will have two mechanized sand molding lines—one for regular grey iron engine blocks and castings, and another for "soft" grey iron and malleable iron castings. Controlled-atmosphere annealing kilns will be used for making malleable iron castings. When completed, the foundry will produce approximately 65 tons of castings per eight-hour day.

## LPG Engines Are Offered On 1957 Ford Tractor Line

Liquefied petroleum engines for all models and a wider selection of front wheel arrangements for its "row crop" types feature the Ford tractor line for 1957. The new models went on display in Ford tractor and implement dealer salesrooms on Jan. 25.

The LPG engines supplement the standard gasoline engine models. The LPG system used by Ford is of the liquid withdrawal type for either propane or butane-propane fuel.

# AND AVIATION INDUSTRIES

## Special Dodge Truck Produced For Hauling of House Trailers

Dodge is now producing a special truck for pulling house trailers. The new C-100 pickup is powered by a 204-hp, V-8 engine. It has a four-speed heavy-duty transmission, dual rear wheels, and a special large capacity radiator.

## Congress Probing Into Delays In New Roadbuilding Program

Dissatisfaction with the conduct of the campaign to modernize America's highways and streets may be reflected in the introduction of new legislation in Congress.

One possible bill, repeating a proposal made to Congress last year, may prescribe the creation of a new Federal agency to administer highway construction. This act would divest the Bureau of Public Roads of its authority to foster and coordinate highway planning and building.

A subcommittee headed by Sen. Gore (D., Tenn.) opened hearings in January to probe the reasons for apparent delay in progress on new roadbuilding. At that time, contracts had been let for construction of 500 miles of roads in the Interstate Highway system, now planned as a 41,000-mile superhighway network.

The interim Federal Highway Administrator, John Volpe, gave the value of Interstate System projects actually contracted for as \$300 million. Total allocated spending for the system, comprising projects contracted for and those advertised, was well over \$900 million.

Steel and cement supplies are tight, and their availability—or lack of it—will have marked influence on the speed of construction, Mr. Volpe said. He noted that in some areas 20-month deliveries are anticipated on heavy structural components.

W. A. Bugge, president of the American Association of State Highway Officials, revealed that eight state highway departments say they must find additional funds to match Federal road grants. Twenty-four departments have advised that they would ask their legislatures for increased highway revenues.



## SMALL CZECH CARS SHOW ECONOMY IN CONSTRUCTION

The two Czechoslovak baby cars shown here were developed by aircraft factories. The three-seater Avia (right) uses the same front and rear body pressings to cut production costs. Engine is a two-cylinder aircooled unit in the rear compartment. The chassis consists of a central tubular backbone with swing axles at the rear. The Moravan (left) is larger but of smaller design. All wheels are independently suspended on swing axles of pressed steel whose inner forks are linked to the backbone.

## New Parts Warehouse Opened By Buick at Camp Hill, Pa.

Buick has opened another new parts warehouse under its program to expand such facilities throughout the country. Located at Camp Hill, Pa., the new unit will serve dealers in parts of the Philadelphia, Newark, Buffalo, and Pittsburgh zones.

## Kelsey-Hayes To Expand Vacuum Metals Facility

A 100,000 sq ft plant and office building will be constructed by Kelsey-Hayes Co. for its Utica drop forge and tool division's vacuum metals facility near Utica, N. Y. The expansion will enable the company to broaden its research and development work on alloys for civilian uses. Nearly all of the output of its present vacuum metals plant located in New York Mills, also near Utica, has been going for military use.

## Ford Determined to Nail Down Bigger Share of Truck Market

The continued upward trend that can be expected in the motor transport industry is cited by R. S. McNamara, general manager of Ford Div. Speaking at a National Trucking Conference in Dearborn, Mich., last month, he predicted that annual

truck production would total 1.5 million by 1965. This would be a 35 per cent increase over 1956.

It was also disclosed that Ford is out to capture 34 per cent of the expected domestic market of 960,000 trucks in 1957. The company spent \$77 million for engineering and tooling on the 1957 models to aid its push toward this objective. About \$5 million of this sum was used to shave a year off the introduction date of the new line. The many changes in the 1957 models were originally not scheduled to appear until 1958.

## Progressive Future Viewed for S-P by Curtiss-Wright

The time-honored Packard car is here to stay and, along with Studebaker, will aim at a selective type of market. Production and sales will not be forced on either line, but both makes will be backed up by a forceful promotion campaign designed to appeal to buyers who seek high-quality "prestige" automobiles.

This, in brief, is the philosophy to be followed by Studebaker-Packard Corp. in the reinforcement of its position in the automotive market, as summarized by Roy Hurley, president of Curtiss-Wright Corp., at a recent informal press conference in Philadel-

# News of the AUTOMOTIVE

phia. The latter holds a 10-year management contract with Studebaker-Packard and is bending every effort towards getting it to stand on its own feet as a strong independent force in the automobile industry. Proof of the success already achieved, Mr. Hurley stated, was the fact that S-P operations reached the break-even point in November, 1956.

Commenting further on Curtiss-Wright's plans for Studebaker-Pack-

ard, Mr. Hurley said that many new developments are in various stages of progression. While not at liberty to disclose details, he did say that some interesting things could be expected from Curtiss-Wright's working agreement with Daimler-Benz of Germany. In addition, Studebaker will continue to be active in the truck field with continuous improvements, and new possibilities in the passenger car area are by no means being overlooked.

## Work on Ferguson Projects Continues; Details Hidden

Harry Ferguson Research, Ltd., is still closely guarding the secrets of its "revolutionary" vehicle design to help the British motor vehicle industry stage a revival in sagging export markets. It has affirmed that it now has close ties with Standard Motor Co. in developing the Ferguson automatic transmission for the Vanguard and "Ten" passenger cars.

According to a Ferguson spokesman, "friendly talks" are taking place with several other British companies. Aim is to make this "very advanced and economical" transmission available to all the leading manufacturers on which Britain's car exports depend.

Meanwhile, all progress on introducing a new range of cars and trucks is under wraps, since foreign manufacturers "are showing a lively interest. Considerable efforts are being made to provoke us into premature revelations," it is stated, "by the circulation of rumors that our projects have been abandoned. There is no truth whatsoever in such rumors."

Development is reported to be continuing rapidly, although test work is admittedly hampered by the intense curiosity and the need to avoid satisfying it. Ferguson apparently intends to take no risk of overseas competitors uncovering and adopting his designs.

## Abrasive Wheel Safety Code Revised and Made Available

The American Standards Association recently approved the revised edition of the 1947 Safety Code for *The Use, Care, and Protection of Abrasive Wheels*. The revisions were made under the sponsorship of the International Association of Governmental Labor Officials and the Grinding Wheel Institute.

The new abrasive wheel safety code represents a major revision of its 1947 counterpart. In addition to a new size and new format, some changes in content have been made.

Readers desiring copies of the new safety code may request them on their company letterheads from Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, O.

## 1957 WEEKLY U. S. MOTOR VEHICLE PRODUCTION

As reported by the Automobile Manufacturers Association

Make	For Weeks Ending			Total—Jan. 1 to—	
	Jan. 19	Jan. 12	Jan. 5	Jan. 19, 1957	Jan. 21, 1956
<b>PASSENGER CAR PRODUCTION</b>					
Hudson	98	94	82	242	1,011
Nash	162	235	148	545	2,301
Rambler	1,967	1,842	1,085	4,894	6,294
Total—American Motors	2,225	2,171	1,285	5,681	9,606
Chrysler and Imperial	4,200	3,791	2,344	10,335	8,655
De Soto	3,660	3,643	2,203	9,506	8,784
Dodge	6,131	6,363	5,783	16,277	16,728
Plymouth	14,934	13,299	7,987	36,220	37,414
Total—Chrysler Corp.	28,925	27,096	16,317	72,338	71,611
Ford	34,358	35,588	22,241	92,187	86,158
Lincoln and Continental	1,419	1,266	853	3,538	3,885
Mercury	8,586	8,353	5,696	22,789	16,408
Total—Ford Motor Company	44,335	45,187	29,092	118,614	106,452
Buick	12,419	12,033	8,477	33,829	46,557
Cadillac	3,472	3,315	1,972	8,759	9,470
Chevrolet	33,519	35,020	20,867	89,406	104,086
Oldsmobile	10,226	10,467	6,524	27,217	34,369
Pontiac	9,359	9,367	5,371	24,087	26,011
Total—General Motors Corp.	68,975	71,142	43,211	183,328	220,473
Packard	400	271	208	879	2,466
Studebaker	852	2,060	1,069	4,001	10,080
Total—Stude-Packard Corp.	1,252	2,331	1,297	4,880	12,466
Checker Cab	34	103	32	169	23
Total—Passenger Cars	145,746	148,030	91,234	385,010	420,630
<b>TRUCK PRODUCTION</b>					
Available	7	2	1	10	8
Chevrolet	7,375	7,834	4,606	19,814	23,495
G. M. C.	1,478	1,713	1,075	4,266	4,531
Diamond T	80	83	66	208	278
Dodge	78	78	48	204	280
Dodge and Fargo	1,588	1,487	1,255	4,330	4,823
Ford	5,727	3,301	595	9,623	19,470
International	2,917	2,961	2,775	8,668	8,823
Nash	411	384	192	986	1,050
Reo	71	72	19	162	195
Studebaker	217	351	24	592	1,090
White	346	338	196	873	1,173
Willys	1,556	1,353	0	2,909	3,482
Other Trucks	95	98	85	278	427
Total—Trucks	21,946	20,635	10,936	52,245	66,805
Buses	64	69	38	171	232
Total—Motor Vehicles	167,756	168,134	102,208	437,426	489,667



# AND AVIATION INDUSTRIES



## JET PARTS SMOOTHED

The tumbling machine pictured was specially designed and built for Solar Aircraft Co. to hone edges of large precision assemblies. Components manufactured by Solar for jet engines are placed in a revolving barrel containing an abrasive mixture. As the barrel rotates, sharp edges and nicks are smoothed and cleaned.

## Bendix 1956 Sales Increased; Earnings Had Slight Decline

Net sales, royalties, and other operating income of Bendix Aviation Corp. for the fiscal year ended Sept. 30, 1956, were \$581,418,734, compared to \$567,249,923 for the previous year. Earnings for the year were \$24,278,263, compared with \$25,888,599 in 1955.

The corporation's backlog of unfilled orders increased during the later months of the fiscal year. It stood at \$544 million on Sept. 30, compared with \$480 million at the end of the previous year.

Breaking down Bendix' actual sales for the fiscal year, which increased 2½ per cent to \$578 million, the report shows that the major categories of output of the corporation remained approximately the same as for the previous year. Aviation products again represented 63 per cent; automotive products, 18 per cent (down two per cent); and industrial, consumer, and miscellaneous military products 19 per cent (up two per cent). Total Bendix production for the armed services and Government in 1956 represented exactly the same percentage, 69 per cent, as in 1955.

# AAI TABLOID

Kaiser Aluminum & Chemical Corp. has purchased the wire and cable business of U. S. Rubber Co.

\* \* \*

Parker Rust Proof Co. is building its sixth manufacturing plant in St. Louis, Mo.

\* \* \*

Standard Pressed Steel Co. will spend more than \$7 million on new plant and equipment in 1957. . . . Budd Co. is appropriating \$10.5 million for capital outlays in 1957.

\* \* \*

Aluminum Industries, Inc., has purchased Wisconsin Machinery & Manufacturing Co.

\* \* \*

Parish Pressed Steel Div. of Dana Corp. has completed an expansion program at its Reading, Pa., plant that will mean a 40 per cent increase in its automotive frame production.

\* \* \*

North American Aviation, Inc., has halted nine years' continuous production of the F-86 Sabre Jet fighter.

\* \* \*

E. W. Bliss Co. has acquired a 20 per cent interest in Chemetals Corp. The latter is involved in the production of copper powder and fabrication of copper strip and other wrought shapes.

\* \* \*

General Electric Co. will spend about \$170 million for plant expansion in 1957.

\* \* \*

Bendix Aviation Corp. has been awarded a \$27 million Navy contract for the production of Talos guided missiles.

\* \* \*

Tatnall Measuring Systems Co., a new wholly-owned subsidiary of The Budd Co., has purchased a building in Phoenixville, Pa., to house its office and production facilities.

Fischer & Porter Co. has purchased two tracts in Bucks County, Pa., for expansion purposes.

\* \* \*

Due to Defense Dept. withdrawal from participation, the National Aircraft Show will not be held this year.

\* \* \*

Sikorsky Aircraft Div. of United Aircraft Corp. has developed a design for a new turbine-powered 17-20 place helicopter. It would use two GE T-58 turbine engines placed on top of the pilot's compartment.

\* \* \*

M. W. Kellogg Co. has developed a new process designed to convert low octane gasoline into a high octane product.

\* \* \*

Vulcan Tool Co. has purchased the Brehm Die Div. of Steel Products Engineering Div. of Kelsey-Hayes Co.

\* \* \*

Pines Engineering Co., Inc., has made available a color sound film showing the latest machine bending techniques.

\* \* \*

Pratt & Whitney Aircraft Div. of United Aircraft Corp. has announced a new medium-sized jet-turbine engine. Designated the J-52, it is already scheduled for installation in the Navy Douglas A4D Skyhawk.

\* \* \*

Solar Aircraft Co. has been awarded a Navy contract for the development of a new gas turbine.

\* \* \*

Trecker Aircraft Corp. has produced a new and more powerful model of the Royal Gull amphibious plane. Known as the "Super 200," it is powered by two 340-hp supercharged Lycoming engines.

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## MERCEDES-BENZ ADDS NEW SPORTS CAR TO ITS LINE

The new Mercedes-Benz 300SL Roadster will be introduced to the public next summer. It will be a six-seater with a six-cylinder, 240-hp gasoline engine and Bosch fuel injection system. The car will be previewed at the Geneva Automobile Show.

## Decentralization Effects Highlighted in Report

Effects of decentralization in the automobile industry are noted in a comprehensive report by the Detroit Metropolitan Area Regional Planning Commission. It shows that the Detroit Region will remain the core of the industry, but its share of total automobile employment and production will continue to decrease gradually as automotive plants are decentralized.

In 1955, the Detroit region accounted for 36 per cent of national

automotive employment. This was a 10 per cent decline from 1939, even though national automotive employment nearly doubled in that period.

The entire state of Michigan actually showed an increase of only 30 per cent from 1947 to 1955. California, on the other hand, jumped by 117 per cent. During the same period, Indiana realized a 30 per cent increase in employment; Wisconsin, 27 per cent; Ohio, 22 per cent; and Illinois, 12 per cent.

Percentage figures, however, do not reflect the relationships of the leading states in terms of actual employment. Michigan still leads the country in actual numerical growth in automotive workers, in gaining 115,000 between 1947 and 1955. California during that period gained only 19,000.

The number of automotive plants and employment are increasing faster in other areas, but the Detroit region still remains the focal point of the industry. Most of the heavy expansion is still being done in Detroit and adjoining areas.

Chief reasons the industry has been the mainstay in Detroit are simple ones: easy access to raw materials; primary suppliers; and subsidiary industries. Automobile companies have, of course, been constructing new assembly plants in outlying strategic market areas for economical purposes. But the Detroit Region has shared equally in expansion.

Since 1947, 20 new plants have been built in the Detroit Region by Ford, Chrysler, and General Motors. In addition, many millions of dollars have been spent modernizing and expanding older facilities.

## First Aluminum Sheet Rolled at Kaiser Ravenswood Works

The first aluminum sheet is rolling out from the initial operating units of the \$200-million works Kaiser Aluminum & Chemical Corp. is building at Ravenswood, W. Va.

Now in production are cold-rolling facilities, along with annealing furnaces, slitters, shears and other auxiliary equipment, for turning out light-gauge sheet.

Kaiser Aluminum is constructing two plants, each a great facility in its own right, at Ravenswood. They are laid out on the 2500-acre Ohio River site to provide maximum efficiency in an integrated operation. Molten primary aluminum produced from alumina in the reduction plant will be cast directly into ingots for the adjacent rolling mill.

When completed, the rolling mill will have an annual capacity of 169,150 tons of fabricated products. The reduction plant initially will have four potlines with an annual capacity of 125,000 tons of primary aluminum.

## SIX MAKES SHOW GAINS IN NOVEMBER OVER OCTOBER

### 1956 New Passenger Car Registrations\*

Arranged by Makes in Descending Order According to the 1956 Eleven Months' Totals

MAKE	ELEVEN MONTHS							
				Units		Per Cent of Total		
	November 1955	October 1955	November 1956	1955	1956	1955	1956	1956
Chevrolet.....	112,618	114,633	121,295	1,439,286	1,479,529	26.39	22.60	
Ford.....	117,100	109,180	130,387	1,238,988	1,429,580	22.72	21.83	
Buick.....	24,394	33,772	34,271	469,286	679,717	8.99	10.39	
Plymouth.....	34,679	27,896	40,680	440,107	897,410	8.09	9.12	
Oldsmobile.....	21,628	31,053	37,008	403,176	638,433	7.41	8.23	
Pontiac.....	21,633	26,316	38,815	330,708	486,873	6.08	7.44	
Mercury.....	14,969	19,798	29,948	253,966	342,121	4.67	5.23	
Dodge.....	15,722	14,079	20,743	290,523	263,849	3.69	4.03	
Cadillac.....	9,524	7,562	11,781	121,086	128,726	2.23	1.92	
Chrysler.....	8,023	7,487	10,680	167,289	143,572	1.97	2.19	
De Soto.....	5,626	6,609	8,328	91,439	107,948	1.66	1.85	
Nash.....	7,183	6,360	6,683	77,199	87,603	1.42	1.34	
Studebaker.....	4,627	3,794	5,109	70,695	88,866	1.30	1.38	
Lincoln.....	2,983	3,155	3,421	39,363	30,969	.72	.47	
Hudson.....	1,321	1,810	2,229	29,357	40,578	.64	.62	
Packard.....	967	1,367	3,625	27,736	48,147	.61	.74	
Continental.....	84	68	200	1,415	359	.03	.08	
Misc. Domestic.....	395	364	255	3,701	7,318	.07	.11	
Foreign.....	8,192	9,164	4,999	80,906	46,547	1.49	.71	
Total—All Makes...	403,948	424,414	509,155	5,447,187	6,545,054	100.00	100.00	

\* Based on data from R. L. Polk & Co.

# AND AVIATION INDUSTRIES

## Fury V-800 Engine Offered For All Plymouth '57 Cars

Plymouth is now offering a new Fury V-800, 290-hp engine on all models of its 1957 cars. It has eight-barrel carburetion, a displacement of 318 cu in., and a 9.25 to 1 compression ratio.

The engine is also equipped with dual exhausts, special domed pistons, high intensity cams, high load valve springs, a high performance electrical system, and other high performance components.

The standard Plymouth chassis has been altered where the Fury engine is used to handle the increased performance.

## New Air-Compressor System Being Constructed By Buick

A new air compressor system, which will boost total capacity by 20,000 cfm, is being constructed by Buick at Flint, Mich. The company notes that last year it used more than 20 billion cu ft of compressed air to power various manufacturing devices at its plants.

## Car Output Geared To Market Demand

While total automobile production during the opening weeks of 1957 admittedly was down from the same period last year, there are some encouraging reports to indicate the industry may have a good first quarter. Several car makers expect their output to top that of last January-March. Cutbacks by some others, however, are creating mixed opinions on the total number of cars the industry will turn out the first three months.

January production increased by about 4 per cent over the same month last year and was somewhat under December's high rate. Nonetheless, the industry appears to be in a considerably better position now than it was a year ago. Inventories have been reduced by about 200,000 units under last January's 750,000, and output is being geared closer to the market potential.

The reduction in stocks may be the first step toward achieving the industry's goal of stabilizing production to



## SIATA BUILT ON MODIFIED FIAT CHASSIS

Siata of Italy has introduced to the market its Amica 56 car built on a reinforced Fiat chassis. Increased interior space, curved windshield, and sports-type steering wheel are among a number of modifications that have been made to the basic unit.

attain a year-around pattern. Some industry officials believe output will be maintained at a steady rate of between 140,000 and 150,000 cars a week during the first half of this year. That rate was maintained throughout most of January, with output ranging from 143,000 to 148,000. The notable exception was the Jan. 1-5 period, when only 91,000 cars were turned out because of a short work week.

If the industry is able to maintain

the January rate, output for the first quarter should about equal last year's 1.6 million cars. Encouraging sales reports have prompted several car makers to boost output substantially in the first quarter. Among them are Chrysler Corporation, which is scheduling to build one-third more cars than during the January-March period last year; Lincoln, which has hiked output by 22 per cent; and Ford and Mercury, both of which have been up.

(Turn to page 130, please)

## TOP LEADERS LOSE PERCENTAGE IN SMALLER MARKET

### 1956 New Truck Registrations\*

Arranged by Makes in Descending Order According to the 1956 Eleven Months' Totals

ELEVEN MONTHS							
MAKE	November	October	November	Units		Per Cent of Total	
	1956	1956	1955	1956	1955	1956	1955
Chevrolet.....	24,918	25,604	26,577	290,114	295,090	33.79	34.17
Ford.....	19,322	23,146	21,183	245,792	267,820	29.66	30.99
International.....	7,737	9,317	6,683	100,472	92,960	12.12	10.76
G. M. C.....	8,794	6,297	7,798	76,256	75,004	9.20	8.69
Dodge.....	4,204	4,417	4,738	82,719	90,803	6.36	7.04
White.....	1,080	1,280	1,184	14,183	13,073	1.71	1.81
Willys Truck.....	1,220	1,346	1,567	12,625	15,022	1.52	1.74
Mack.....	870	1,196	992	12,069	9,831	1.46	1.14
Willys Jeep.....	866	912	955	8,181	9,229	.99	1.07
Studebaker.....	448	469	653	8,106	10,016	.96	1.16
Diamond T.....	253	403	297	3,704	3,353	.45	.39
Divco.....	209	257	263	2,946	3,066	.38	.36
Reo.....	206	316	262	2,788	2,838	.34	.33
Kenworth.....	46	104	158	1,177	1,135	.14	.13
Brockway.....	56	53	126	829	1,010	.10	.12
Peterbilt.....	32	66	32	671	410	.07	.06
F. W. D.....	40	39	33	413	252	.06	.03
Misc. Domestic.....	120	131	82	1,132	894	.14	.10
Foreign.....	570	700	213	4,638	1,895	.56	.22
Total—All Makes..	66,983	76,062	75,756	825,897	893,268	100.00	100.00

\* Based on data from R. L. Polk & Co.

# Men in the News



*Warner Electric Brake & Clutch Co.—Alonzo A. Neese has been named chairman of the board.*

Ford Motor Co.—J. E. Lundy and John Sagan have been elected treasurer and assistant treasurer, respectively.

Chrysler Corp.—M. C. Patterson and T. F. Morrow have been elected vice-presidents.

Goshen Rubber Co. — William J. Johnson has been named president and general manager; Richard G. Bigler, assistant to the president; and, Wayne Burger, treasurer.

Chevrolet Motor Div., General Motors Corp.—L. R. Mason has become regional manager in charge of the company's eastern assembly plants, while D. D. Douglass occupies a similar position over assembly plants in the west.

Willys Motors, Inc.—S. W. Connelly has been appointed director of Government sales.

International Nickel Co. of Canada, Ltd.—J. Roy Gordon has been elected executive vice-president.

Magnaflux Corp.—Roy O. Schiebel has been elected second vice-president.

Pesco Products Div., Borg-Warner Corp.—M. W. Nesbitt has been appointed director of engineering.

Mack Trucks, Inc. — Theodore J. Zeller has been made vice-president of forward planning; Walter M. May, vice-president of engineering; Clarence H. Smith, vice-president; and Harvey W. Bush, vice-president of operations.

Bullard Co.—Paul L. Smith was named assistant controller.



*Superior Steel Corp.—Robert C. Downie has been made assistant to the president and assistant general manager.*

General Motors Corp.—Earl R. Bramblett has been appointed director of labor relations.

Ford Motor Co., Tractor and Implement Div.—Merritt D. Hill has been appointed general manager, succeeding Irving A. Duffy, now group vice-president of the company.

Goodyear Tire & Rubber Co.—Sam DuPree has succeeded retiring Joseph E. Mayl as vice-president, general products group. R. B. Warren was named general manager of the Industrial Products Div.

Acme Steel Co. — Fred M. Gillies was elected chairman and chief executive officer, and Guy T. Avery was elected president and chief administration officer.

Carpenter Steel Co.—John Moxon was elected executive vice-president.



*Young Radiator Co.—Harry M. Gill has been appointed advertising manager.*

Westinghouse Electric Corp.—Clarence Zener has been appointed director of the Research Laboratories.

Progressive Mfg. Co.—Warren F. Bice has been appointed general manager.

Edsel Div., Ford Motor Co.—William O. Bourke was made Distribution Department Manager, and A. H. Prairie was chosen manager of the Purchase Analysis Dept.

Michigan Tool Co.—Clayton E. Scott is now plant manager of the Six Mile Road plant, and Richard S. Hildreth succeeds him as chief engineer for the Machine Tool and Cutting Tool Div.



*Federal - Mogul - Bower Bearings, Inc., Federal - Mogul Div.—Robert E. Klare was promoted to general manager.*



*Cadillac Motor Car Div., General Motors Corp. — Frederic H. Murray was appointed general sales manager.*

Chrysler Corp., Engine Div.—Vernon A. Albaugh has been promoted to manager of production control.

Pheoll Manufacturing Co.—Stanley Adamek has been appointed manager of manufacturing.

Allen Manufacturing Co.—Willis D. Horner has been elected vice-president in charge of sales.

Perfect Circle Corp. — Robert M. Thomas has become staff sales consultant, and Rufus P. Austin succeeds him as sales manager of the Manufacturers' Div.

*(Turn to page 126, please)*

## Necrology

Hugh H. C. Weed, 73, former president and board chairman of Carter Carburetor Corp., died recently, at St. Louis, Mo.

Jacob W. Earl, 90, early automotive pioneer, died Jan. 6, at Los Angeles, Calif.

Edward R. Macauley, 53, one-time chief designer for the former Packard Motor Car Co., died Jan. 12, at Detroit Mich.

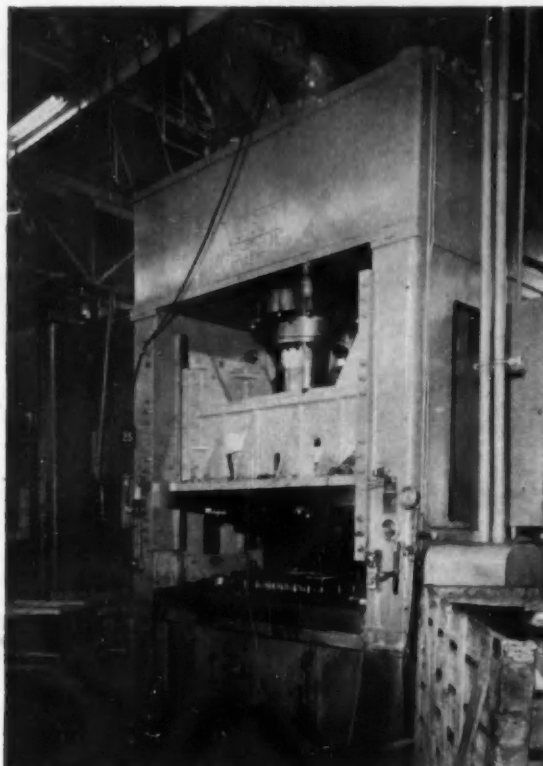
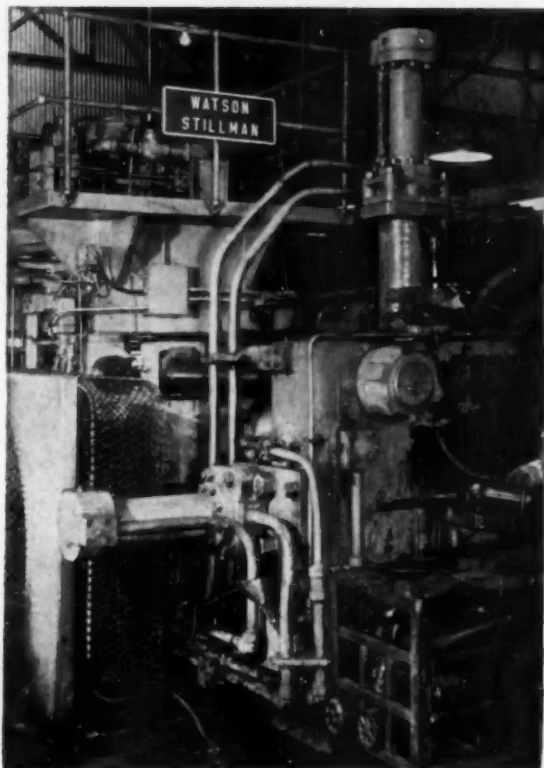
J. Heber Parker, 75, chairman of the board of Carpenter Steel Co., died recently, at Reading, Pa.

Ferdinand W. Breth, 70, vice-president and technical director of L. Sonneborn Sons, Inc., died recently, at New York, N. Y.

Arthur E. Hecker, 65, former assistant to the vice-president of American Cyanamid Co., died Jan. 7, at New Rochelle, N. Y.

Gustave H. Kuechler, 58, manager of licenses and association companies for Combustion Engineering, Inc., died Jan. 9, at New York, N. Y.





## How to assure NO SLUDGE, NO RUST, NO FOAM in hydraulic systems

Here are two case histories of *Texaco Regal Oil R&O* and how it keeps sludge, rust and foam out of hydraulic systems. Names and details on request.

**1.** Even when the extrusion press (left, above) is on 24-hour schedules, the owner reports, operation is perfect with *Texaco Regal Oil R&O*. "No stoppages, no delays in production, no trouble whatsoever. Periodic checks show the oil to be in excellent condition, without a trace of sludge. The entire system stays clean, free from rust and foam."

**2.** After five years of operating the 500-ton press (right, above) on the original charge of *Texaco Regal Oil R&O*, the owner reported: "In spite of the severe service we give it, the press has never had to be down for repairs and the hydraulic system has been completely free of sludge, rust and foam . . . the *Texaco Regal Oil R&O* as clear

as that out of a new sealed drum."

Tests prove that *Texaco Regal Oil R&O* has more than ten times the oxidation resistance of ordinary turbine-quality hydraulic oils — and far superior ability to prevent rust and foam. There is a complete line of *Texaco Regal Oils R&O* approved by leading hydraulic manufacturers for all types of hydraulic equipment.

Let a *Texaco* Lubrication Engineer help you get better performance from all your hydraulic equipment. Just call the nearest of the more than 2,000 *Texaco* Distributing Plants in the 48 States, or write:

The *Texaco* Company, 135 East 42nd Street, New York 17, N. Y.



# TEXACO

CUTTING, GRINDING,  
SOLUBLE AND  
HYDRAULIC OILS

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

# 4

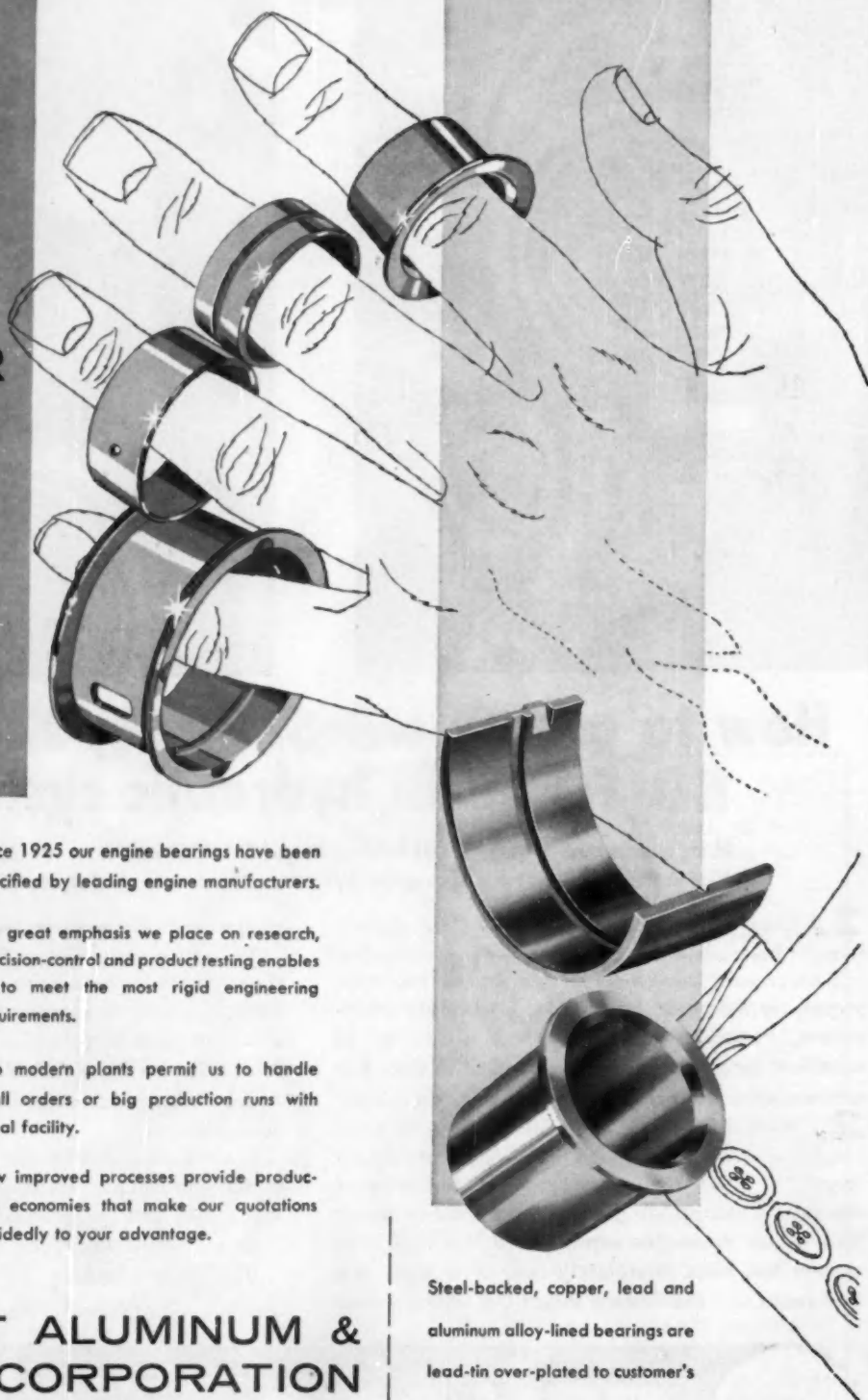
**THINGS  
TO  
REMEMBER  
THE NEXT  
TIME  
YOU  
BUY  
ENGINE  
BEARINGS**

1. Since 1925 our engine bearings have been specified by leading engine manufacturers.
2. The great emphasis we place on research, precision-control and product testing enables us to meet the most rigid engineering requirements.
3. Two modern plants permit us to handle small orders or big production runs with equal facility.
4. New improved processes provide production economies that make our quotations decidedly to your advantage.

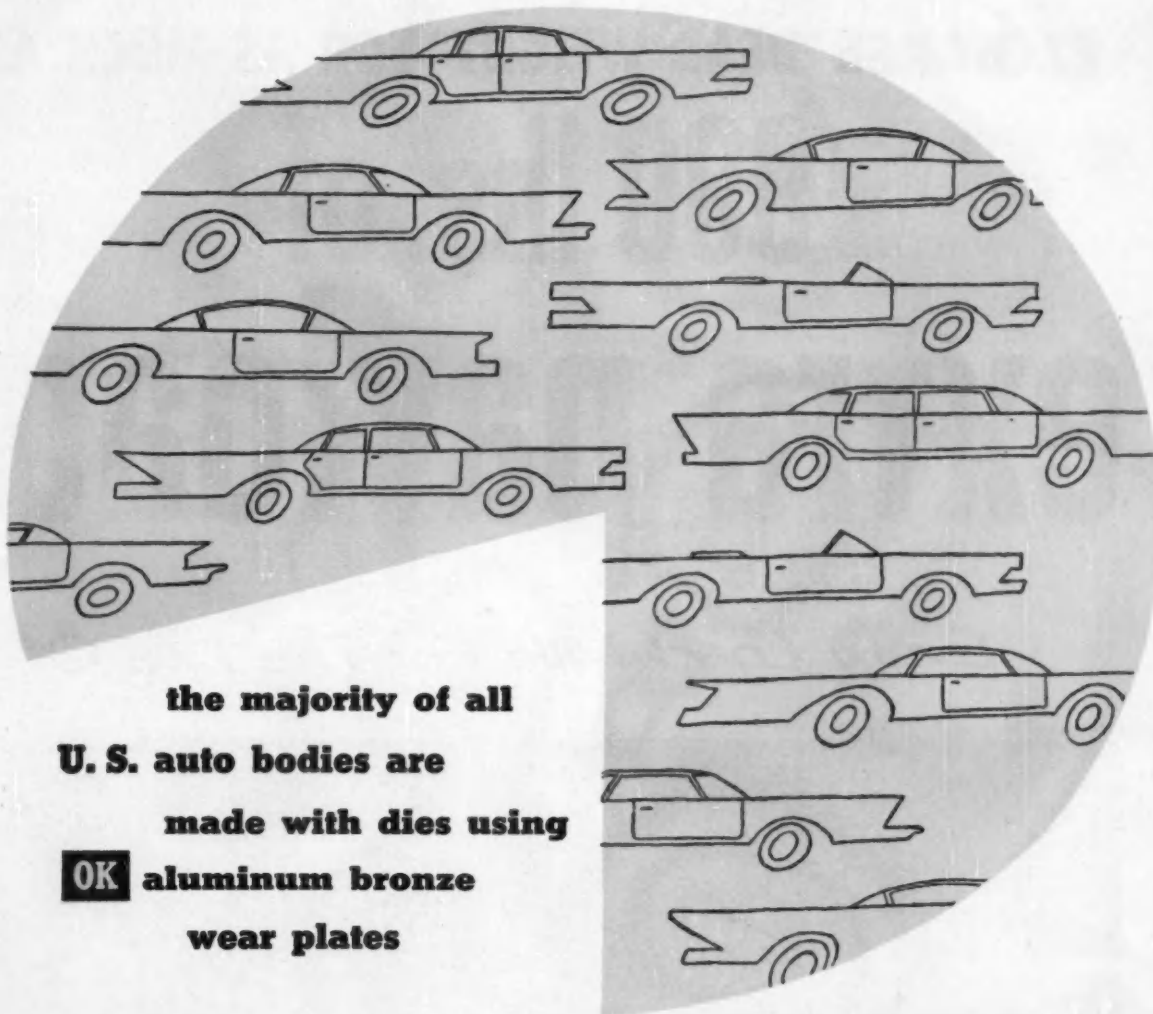
## **DETROIT ALUMINUM & BRASS CORPORATION**

**DETROIT 11, MICHIGAN**

**Plants at Detroit, Michigan and Bellefontaine, Ohio**



Steel-backed, copper, lead and aluminum alloy-lined bearings are lead-tin over-plated to customer's specifications.

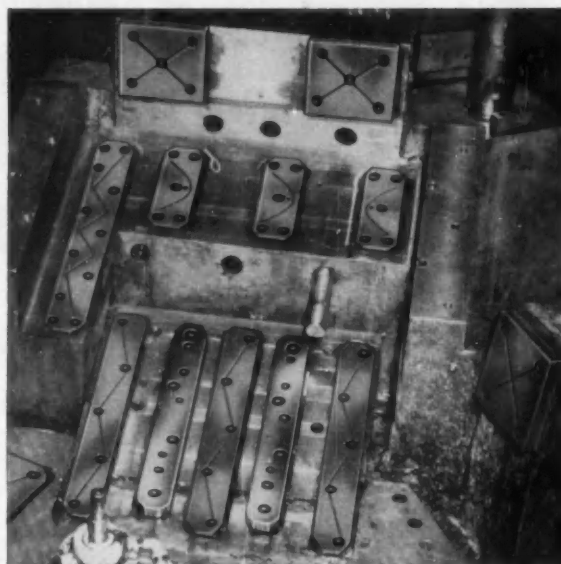


**the majority of all  
U. S. auto bodies are  
made with dies using  
**OK** aluminum bronze  
wear plates**

Here's why: You can save approximately 40% under the cost of expensive solid bronze wear plates . . . and you receive completely finished wear plates, available from stock, ground to  $\pm .0005$  parallel and flat. By a unique cladding process, long wearing aluminum bronze is bonded to a steel base, easily machinable for fitting to dies. Drilling or counterboring can be done through bronze surface if required. Wherever your die has a sliding or cam action, OK aluminum bronze wear plates, because of their great wearing qualities, assure longer die life.

Photo at right shows OK aluminum bronze wear plates in a body die at one of the world's largest automotive plants. Complete information is in our new OK Catalog. For your free copy, write Dept. 55-AB.

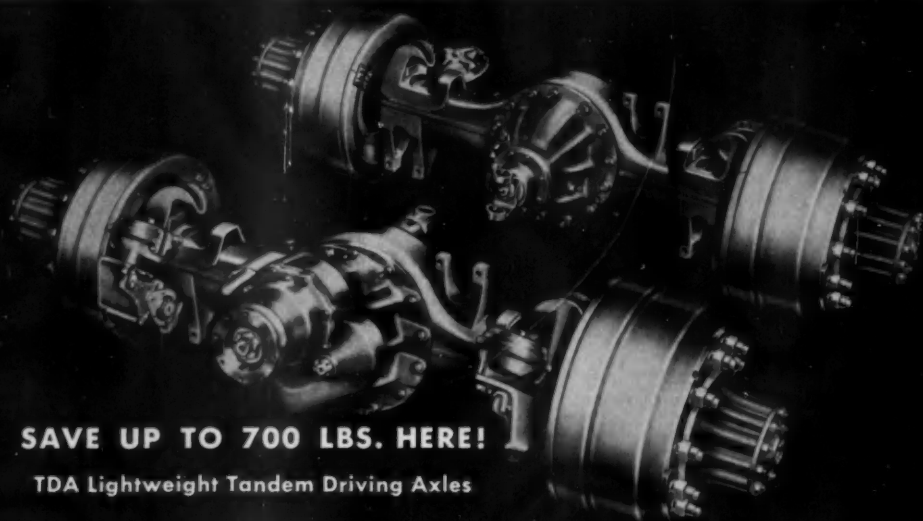
**THE OHIO KNIFE CO.**  
CINCINNATI 23, OHIO



SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES  
• SCRAP CHOPPERS • HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS

**EXCHANGE "DEAD WEIGHT" FOR AS MUCH AS**  
**980 lbs. of**  
**extra payload**

*Every Load-Mile For The Life Of*



**SAVE UP TO 700 LBS. HERE!**

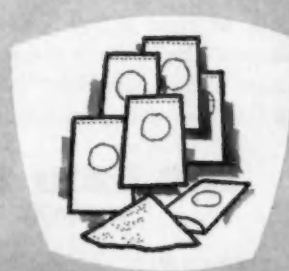
**TDA Lightweight Tandem Driving Axles**

**WHAT THE TDA  
 BONUS LOAD  
 CAN DO FOR YOU:**

*Figure your extra  
 profit, in terms of additional  
 ton-miles of payload!*



**Up to 300 more board feet  
 of lumber per load!**



**Up to 10 more sacks  
 of cement per load!**





**Your Vehicle!**

**Choose the proven weight-saving  
combination of New TDA®  
Tandem Driving and Trailer Axles!**

Used together, Timken-Detroit® lightweight tandem driving and trailer axles weigh almost ½ ton less than other axle combinations of the same capacity. This means up to 980 extra pounds of bonus payload every trip.\*

TDA Axles are the choice of America's leading truck manufacturers. For complete information, contact your original equipment dealer, vehicle dealer or branch today!

*\*Where 36,000 lb. tandem axle loading is permissible.*

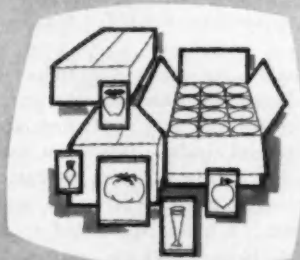
©1957, RS&A Company

**SAVE UP TO  
280 LBS. HERE!**

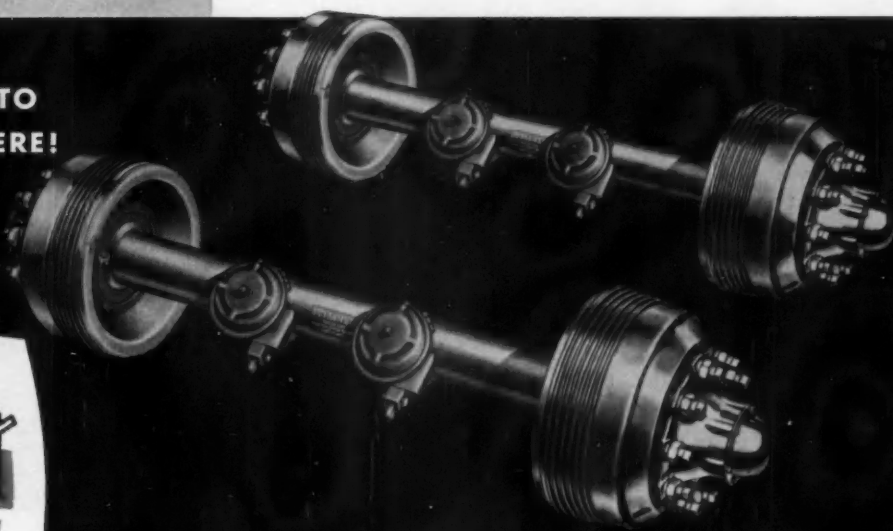
**TDA TK-500 Series  
Trailer Axles**



**Up to 110 more gallons  
of milk per load!**



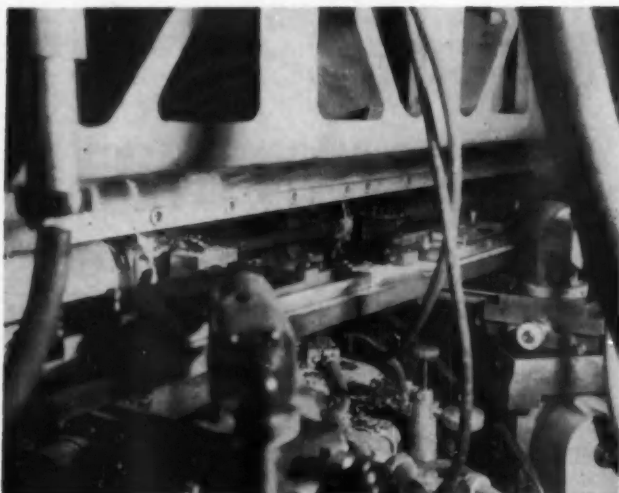
**Up to 21 more cases  
of can goods per load!**



Plants at: Detroit, Michigan • Oshkosh, Wisconsin • Utica, New York  
Ashtabula, Kenton and Newark, Ohio • New Castle, Pennsylvania



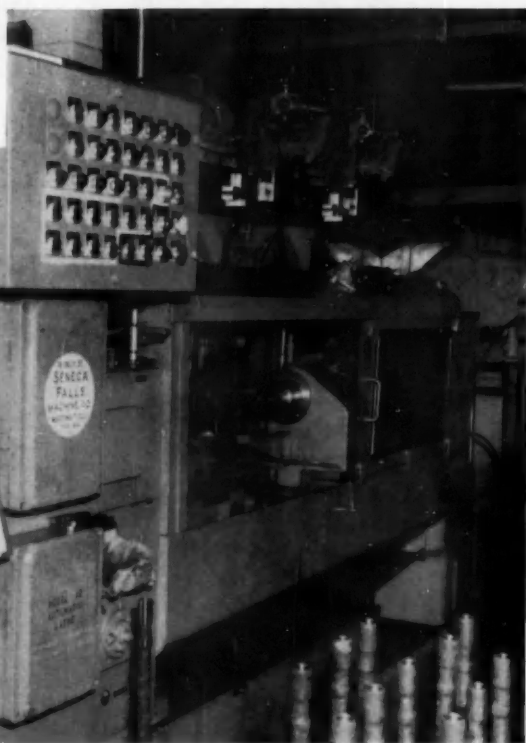
**WORLD'S LARGEST MANUFACTURER OF AXLES FOR  
TRUCKS, BUSES AND TRAILERS**



Close-up of work station of one of the Model AQ LoSwing lathes showing the massive tool blocks in action on both ends of the axle shaft.

## Axle Shafts

One of the battery of four tracer controlled LoSwing Model AQ automatic lathes set up for machining axle shafts.



**E**QUIPMENT of advanced nature, some of it a "first" at this writing, has been installed on a compact, self-contained process line producing flanged rear axle shafts for 1957 cars at Cadillac.

Axle shafts are received as rough forgings, straightened in Impco presses before machining. First operation is handled in LoSwing "CS" centering machines. Discarding the usual milling to length and centering operation, they center drill the flange end and counterbore and center the shaft end with a combination tool.

Turning of the shaft end (excluding the flange) is done in one of four new LoSwing Model "AQ" tracer lathes which are fully automatic in action. Using two cemented-carbide tools for roughing and two for finishing, this lathe finishes the bearing diameter adjacent to the flange as well as three formed radii. At the opposite end, it finishes an oil seal diameter as well as the diameter for the spline. Turning is extremely fussy because of the length of the shaft and the fact that after grinding the oil seal diameter must come out concentric with the OD of the spline within 0.006 in. total indicator reading. Incidentally, when the finishing tool starts its cycle at the spline end, it comes in rapidly to chamfer the extreme corner, then retracts and initiates the main finish-turning cycle.

Besides offering an automatic method of machining axle shafts, the now LoSwing lathe is capable of handling extremely heavy cuts at high speed and feed rates.

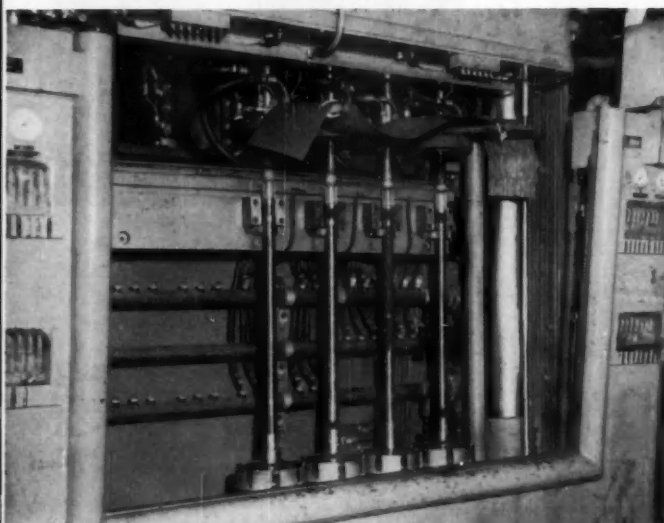
Following turning the spline end is hobbled and the shafts are placed on a monorail conveyor for transport through the washer.

At this point the shafts are ready for induction hardening in the new Tocco machine. As illustrated, it has six stations—four for the axle shaft described here, and two for commercial shafts. Induction hardening in this instance is a highly selective operation. The extreme end of the shaft must be left soft, while at the flanged end hardening must be limited to the end of the flange adjacent to the large radius.

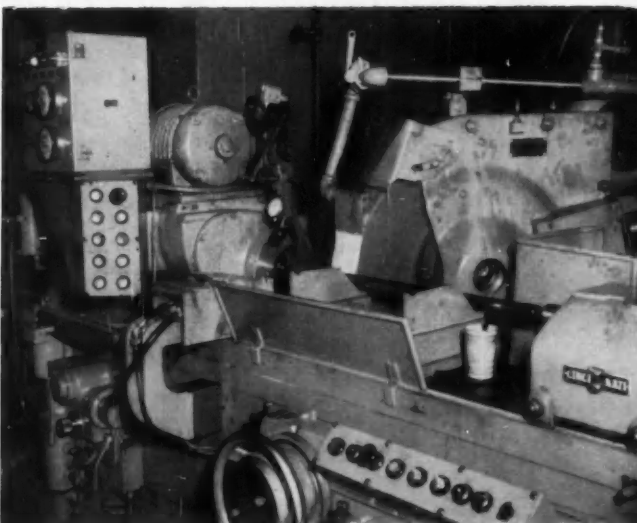
# Are Machined on New Equipment at Cadillac

By Joseph Geschelin

*Close-up of the six-station Tocco induction hardening machine for axle shafts. As illustrated, the flanged end of shafts is held in a chuck at the lower end. Induction blocks are at the top.*



*One of the 10 by 36 Cincinnati 30-deg angular head grinders handling the rough- and finish-grinding of bearing diameter and three faired radii at the flange end of the axle shaft. Federal air-electric sizing gage cabinet is at left.*



In operation, the shaft is held on the center at the upper end while the flange is held in a chuck at the bottom, the chuck being employed for rotating the shafts during hardening. At the start of the cycle the entire fixture is moved upward to engage each bearing section progressively within the induction block and coil. During the interval that each section is being heated the entire group of induction blocks is flooded with water for quenching. The entire cycle, of course, is fully automatic.

Hardness is held to a range of Rc 46 to 52 with a minimum case depth of 0.120 in. As the work is taken out of the Tocco machine it is transferred to a mono-rail conveyor for transport through a tempering oven. This is followed by hardness inspection and a Magna-flux test for acceptance.

Axle shafts are straightened once more in Impco presses, then are processed through another Lo-Swing Model "AQ" tracer controlled lathe for rough- and finish-turning of the flange. These lathes are similar to the first group except that only one pair of cutting

tools is required. This operation not only entails rapid removal of heavy stock but must meet some important engineering specifications. The outer face is required to be finished smooth, also must run true with the bearing diameter within 0.005 in. total indicator reading.

Next follow a group of grinding operations in Cincinnati grinders, each fitted with a Federal air-electric sizing gage. First of these is the grinding of the oil seal diameter. This is held to a total tolerance of 0.004 in. with a surface finish of 30-mu (max.). Next is the rough- and finish-grinding, in separate machines, of the bearing diameter and faired radii at the flange end. Bearing diameter is held to a total tolerance of 0.0006 in. with a surface finish of 30-mu (max.). Moreover, the diameter must be round and straight within 0.0002 in. These rough- and finish-grinding operations are handled in Cincinnati 10 by 36, 30-deg angular feed grinders.

The last major operation is the drilling, chamfering, tapping, and reaming of holes in the flange in an 8-

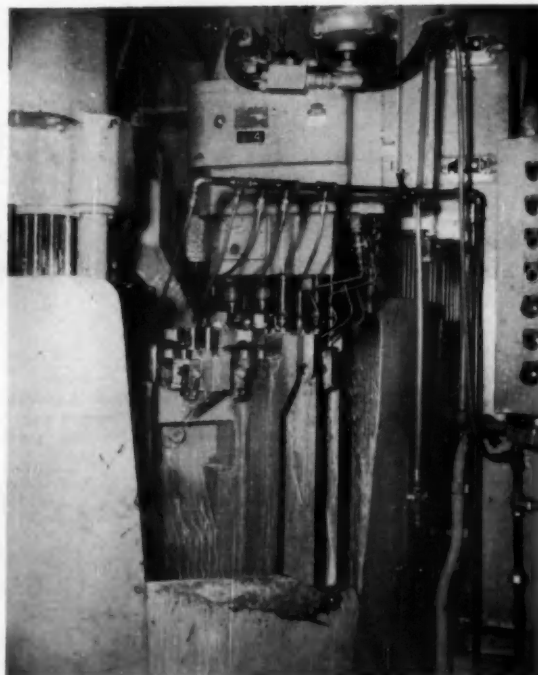
station, LeMaire special vertical type drilling machine. Each station holds two shafts—one RH and one LH. The sequence of events is as follows:

Station 1	Load
Station 2	Drill 14 holes
Station 3	Chamfer 10 holes
Station 4	Combination drill and chamfer two holes
Station 5	Probe inspection of all holes
Station 6	Idle
Station 7	Ream 10 holes and chamfer four holes
Station 8	Tap four holes

The shafts now are burred, hung on a monorail conveyor for transport through the washing operation, and final inspection.

Cadillac has supplied the following information as to speeds and feeds on the Lo-Swing operations: Turning the shaft end is done at 780 rpm or 405 sfpm; feed is 14.04 in. per minute or 0.018 in. per revolution. On the flange operation turning is done at 456 rpm or 742 sfpm; feed 5.70 in. per min, or 0.0125 in. per revolution.

*The 8-station LeMaire machine is compact and complex. Here we see one of the stations in which the flanged end is machined. Each station holds two angle shafts vertically.*



## Reducing Camera Lowers Cost of Engineering Drawings

**By William H. Meier**  
Supervisor of Reproductions  
Chance Vought Aircraft, Inc.



*A large-size engineering drawing is being fed into the reducing camera, which will make a half-size photocopy of it for further reproduction by conventional blueprinting.*

**T**HE reproduction requirements of Chance Vought's engineering and manufacturing departments have mounted with the increasing complexity of our products. As part of our program of cost reduction and streamlining of the operations of the reproductions unit we investigated the Neoflow reducing camera, manufactured by Peerless Photo Products, Inc., and installed one of these cameras in June, 1955.

This precision camera is capable of photocopying large-size original drawings—in any medium or on any stock—on either an intermittent or a continuous flow basis. Multiple work prints can then be made from the reduced-scale copy by blue printing or other photo-duplicating methods.

During the first four weeks of operation, the emphasis was on experimentation and proving. Trial photocopies of reduced-size engineering drawings were made, processed and released to the manufacturing and engineering departments in order to get wide



# New Truck Models introduced by **FORD**

1957 Ford  
F-100  
Pickup Truck



**F**ORD trucks for 1957 feature lower overall height, and reduced cab and front end length. Height has been reduced by nearly  $3\frac{1}{2}$  in. and cabs are now  $2\frac{1}{2}$  in. shorter. At the same time, ground clearance has been increased and turning diameter reduced. Cabs in many series are  $3\frac{1}{2}$  in. wider than their 1956 counterparts. Windshields are increased by two inches in width. There are more than 280 models in the new line.

Engines are equipped with self-locking tappet adjusting screws and a new rotor oil pump. Four basic power plants with nine modifications are available, and engine horsepower has been increased over previous models.

A new addition to the line is the tilt-cab model with a bumper to rear of cab length of 80.3 in. Both the engine and transmission are exposed for maintenance work when the cab is tilted forward.

The Styleside pickup truck (F-100) is rated at a

GVW of 5000 lb, and has a load capacity of 56 cu ft. With outside sheet metal the full width of the truck, greater load bed width is provided. Styleside features are available also on the larger F-250 and F-350 pickup trucks.

Medium and heavy truck frames have been strengthened by increasing depth of side rails over the axle. Larger models use four-barrel carburetors. The P-400 parcel delivery, a new model, is built on a 137-in. wheelbase chassis and is well suited to 10-ft bodies. V-8 engines are available for all parcel delivery trucks.

An original design in the trucking industry is Ford's Ranchero. It has the driving comfort and styling of a passenger car with the working ability of a pickup truck. Built on a 116-in. wheelbase and rated at a capacity of 30.4 cu ft, this vehicle has a double steel floor. The driver compartment and controls are the same as those of a passenger car. The Ranchero can carry a payload of 1200 lb.

plant reaction. The equipment proved to be excellent for the job of reducing blue print costs and filing space requirements as well as for handling the thousands of drawing reproductions we release each month.

In July, 1955, we began using the Neoflow camera on a large percentage of our production drawing releases. Previously, all engineering drawing releases were blue printed actual size. Between 42 and 50 copies were required. By using the camera at a reduction of 2:1, half-size copies of these drawings are obtained, which means an area reduction of 75 per cent. (Reductions of 2.5:1, 3:1, 4:1, 5:1, and 6:1 are also possible.)

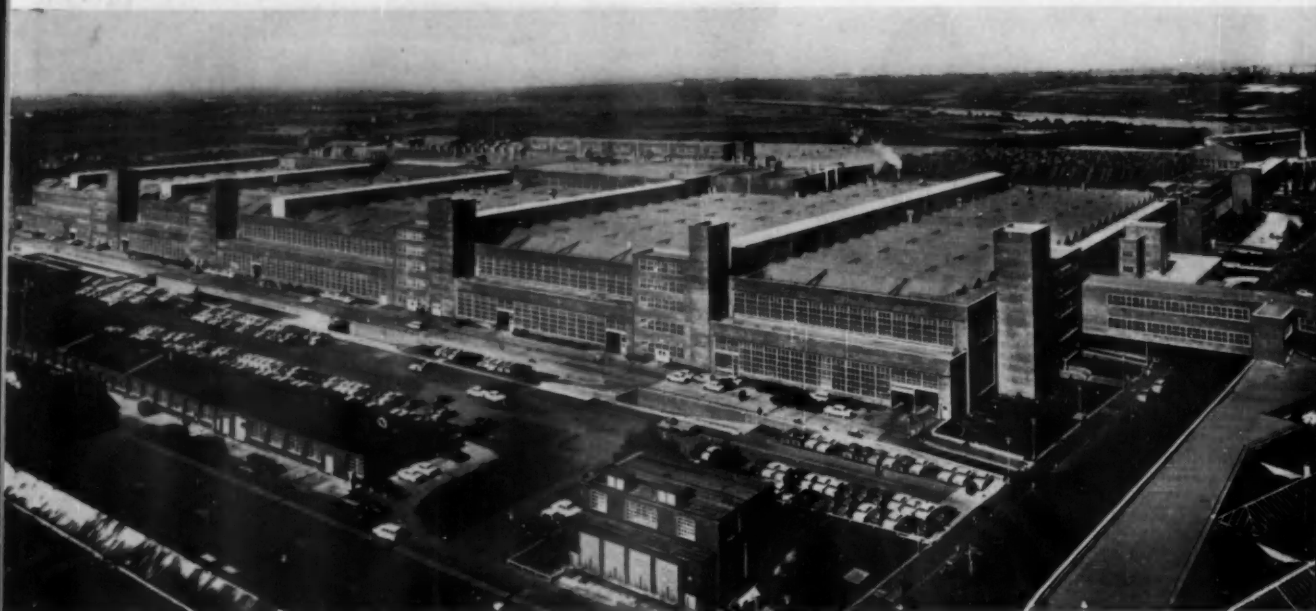
For example, a drawing 34 in. by 110 in. (26.0 sq ft), when reduced to half-size becomes 17 in. by 55 in. (6.5 sq ft), a saving of 19.5 sq ft. Multiply this by the hundreds of thousands of reproductions being made and the savings for paper alone become tremendous. There are over 4000 engineering drawings

on our Crusader airplane alone, 48 per cent of which vary in size from 34 in. by 44 in. to 34 in. by 144 in. prior to reduction. The 75 per cent reduction in paper area resulting from the use of reduced-size copies has saved us \$33,104 in the first year of operation, more than enough to pay for the installation.

Before the installation of the Neoflow camera, our normal monthly blue print output averaged around 800,000 sq ft. Now, the monthly output has been reduced to an average of 300,000 sq ft, a savings of 62 per cent on blue print stock. Against this savings, of course, must be offset the cost of the Neoflow paper.

Principal savings come, naturally, from this cutback on paper requirements. Not to be overlooked, however, are the many operational improvements such as the ability to print twice as many drawings per hour. In addition, with the smaller size blue prints made from these copies, there is a corresponding drop in the

*(Turn to page 102, please)*



New Opel plant has 1400-ft frontage and 100-ft depth. In 1957, daily production is expected to reach 1000 vehicles.



Body transport fixtures carry painted and polished shells of Opel Rekord and Kapitän passenger cars. The shells are transported by overhead monorail conveyors in the mezzanine to vertical conveyors which lead to the final assembly line on the ground floor.

## Streamlined OPEL PLANT

By Robert Braunschweig

**New German Factory  
Has 17 Miles of Con-  
veyors; Will Turn Out  
a Vehicle per Minute**

OFFICIALS of Adam Opel AG, a General Motors subsidiary, expect to attain a daily production rate of 1000 vehicles at the firm's new K-40 plant at Rüsselsheim, Germany. Built at a cost of \$75 million, the new three-story plant is Opel's answer to the growing demand for cars and trucks in West Germany and other territories covered by the firm's sales organization. With this latest expansion, Opel hopes to recapture its former share of the passenger car

market, which fell from 26.4 per cent in 1954 to 19.8 per cent for the first eight months of 1956.

Main feature of the new plant is a 17-mile single conveyor system, consisting of 10 miles of overhead monorail conveyors, 5½ miles of floor chain conveyors, and 1½ miles of moving track. All delivery, sub-assembly painting, and assembly operations are carried out along this conveyor line.

The K-40 plant will turn out the Olympia and Rekord

## PACKARD

*to Concentrate in*  
**Medium Price Field**

▼



*Packard Clipper four-door sedan*

**S**TUDEBAKER-PACKARD CORP. will concentrate its Packard program this year in the medium price field, where up to 80 per cent of its Packard sales have been for the past two years.

The 1957 Packard Clipper line, including the four-door sedan and four-door station wagon, will offer 15 per cent better performance than last year's Clipper and advanced engineering features, among them a supercharger and

automatic transmission as standard equipment. The Twin-Traction differential is available as optional equipment.

The new sedan is 2 in. lower and 300 lb lighter than last year's models, providing a lower center of gravity and improved front-rear weight ratio. Wheelbase is 120½ in. The station wagon, first such body-type for Packard since 1950, has 65-cu ft of load carrying space.

A completely new suspension system for Packard utilizes the variable rate control of front springing adopted by Studebaker-Packard for the first time this year.

Greater engine performance is provided by a completely new engine for this line. It is a 289-cu in. overhead valve V-8 with a supercharger as standard equipment. The engine is rated at 275

*(Turn to page 111, please)*

passenger cars, Caravan station wagon, Olympia delivery van, and the larger Kapitän passenger car. Although this is not a particularly complex program, variations in such things as color and trim make it necessary to use a combined system of punched cards and telescribers to facilitate the production schedule.

Incoming material, body sheet steel, tires, and wheels are stored underground. Located on the ground floor are the press shop and the storage area for stamped sheet metal, as well as the body welding and sub-assembly lines, the final assembly line with two roller test beds, and the central color mixing plant. Vertical conveyors transport the white body assemblies from the ground floor to the mezzanine, where bonderizing, painting and trimming operations are carried out. From there, the bodies are again conveyed to the ground floor for the assembly of mechanical parts.

The drying ovens, the climatizing units, and the fire protection control rooms are located on the roof.

The new plant is considered to be one of the finest examples of American production methods adapted to European requirements. Eventually, its production line will turn out one vehicle every minute.

*Shown below are partially assembled Opel Olympia bodies on a single chain floor conveyor*



**T**HE Lucas fuel injection system, which has given satisfactory results in Jaguar racing cars during the past season, is stated to form the basis for an economic installation in six- and eight-cylinder passenger cars. In essence it consists of an electrically-driven high pressure fuel pump, a secondary filter, a common metering distributor, and a set of injector nozzles.

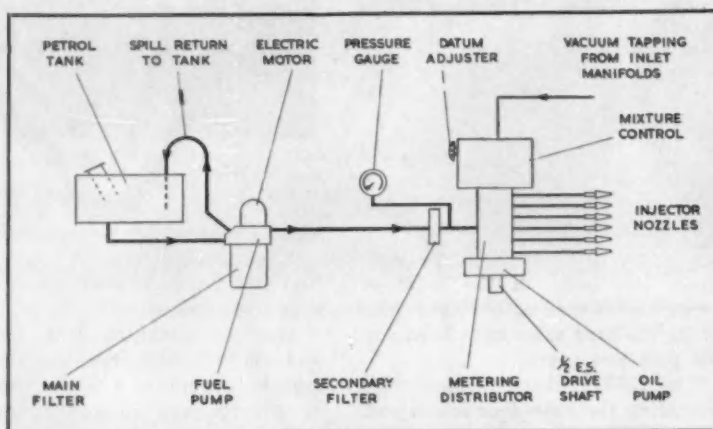
The gear-type pump delivers gasoline at 100 psi, and incorporates a spring-loaded relief valve returning surplus fuel to the tank. The basic injection unit comprises a small shuttle free to slide axially in the lapped bore of a hardened steel rotor, which is carried in a stationary cast iron sleeve and rotated by the engine at half camshaft speed.

Radial ports on both rotor and sleeve alternately connect the two ends of the shuttle bore with the delivery pipe from the pump and with one of the injector nozzles. Incoming fuel switched under pressure thus causes the shuttle to oscillate between stops at the bore extremities as the rotor turns. At the same time, each shuttle movement displaces gas from the previous stroke and injects it into the appropriate cylinder.

The quantity of fuel injected is determined by amount of shuttle travel, and this is varied by a movable stop located indirectly by the throttle. To effect this while maintaining a constant fuel-air ratio over the working range of the engine, a mixture control device is provided.

At one end of the shuttle bore is a sliding stop positioned by an external wedge whose movement is governed by a vacuum-operated piston and cylinder connected to the induction manifold. The throttle is an air valve in the intake tube to each cylinder, and as the throttle opening increases the manifold suction drops. The control wedge is thus moved away from the sliding stop which then retracts from the bore to permit greater shuttle movement and

## Details of the Lucas Fuel Injection System



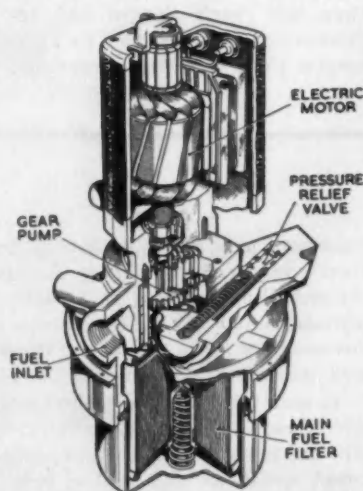
*Schematic diagram of the Lucas fuel injection installation.*

therefore more fuel displacement.

An elaboration of this basic system is used on the high performance engines of Jaguar racing cars. The six-cylinder metering unit has two rotors driven at quarter engine speed. Each of these serves three cylinders and contains two shuttles, three twin inlet ports and three single outlet ports.

There is a datum adjuster for trimming the mixture ratio, and a means of correcting for atmospheric pressure and temperature. Lubrication between rotor and sleeve is provided by a built-in oil pump which delivers pressure slightly above that from the fuel pump. Aside from lubricating the moving parts, this serves to prevent fuel leakage outward along the sleeve.

Fuel enters the metering distributor by a single inlet union and thence passes through twin ports in the rotors to the tandem shuttles. It is then displaced by shuttle movements through the

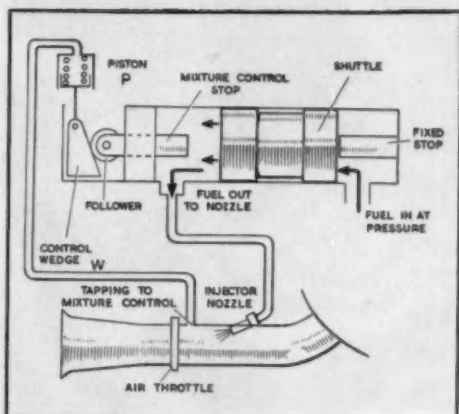


*Sectional view of the fuel supply pump which delivers gasoline at 100 psi to the metering distributor.*

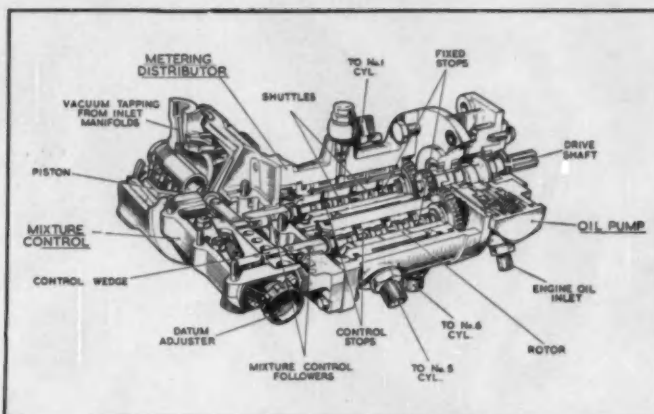
appropriate outlet ports to the injector nozzles.

Injectors have a spring-loaded poppet valve arranged to lift at about 50 pst and spray atomized fuel upstream into each inlet manifold. The slide-type throttle

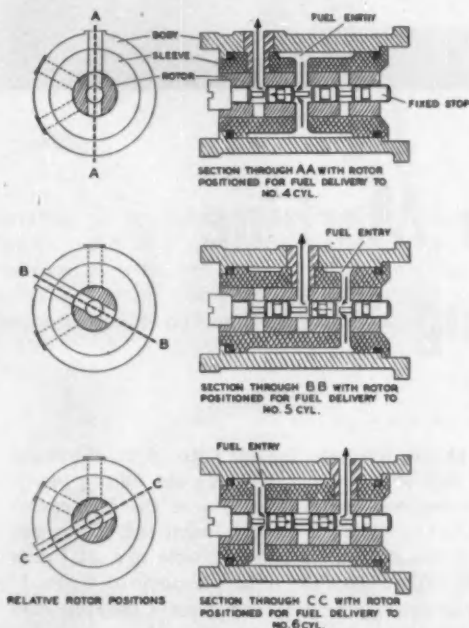




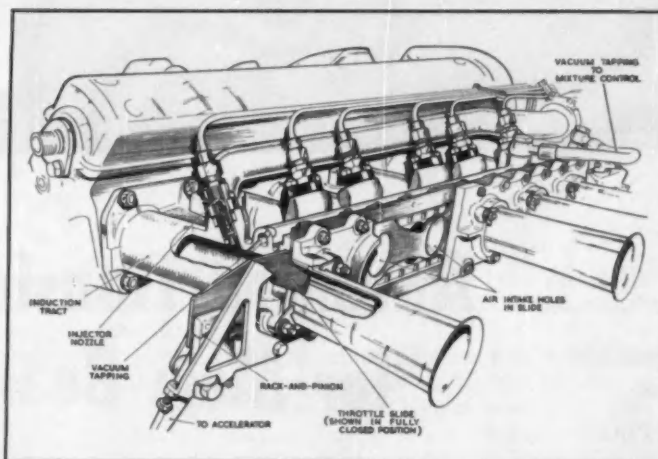
**Basic arrangement of the fuel injection system.** The amount of gasoline metered by the sliding shuttle is determined by the position of the variable stop, and this in turn is regulated by a control wedge vacuum-operated by suction in the induction manifold. A constant air-fuel mixture is thus maintained at all throttle openings.



**Cutaway drawing of the double-rotor fuel metering distributor used on Jaguar racing cars.** Each rotor serves three cylinders, and has two shuttles, three twin inlet ports and three single outlet ports.



**Sequence of shuttle movements for one rotor of a double-unit fuel metering distributor as used in Jaguar racing cars.** The stop at the left is adjustable according to throttle opening, and therefore regulates the quantity of fuel injected.



**Details of the injector nozzles and throttle slide on the induction manifold of a Jaguar racing engine.**

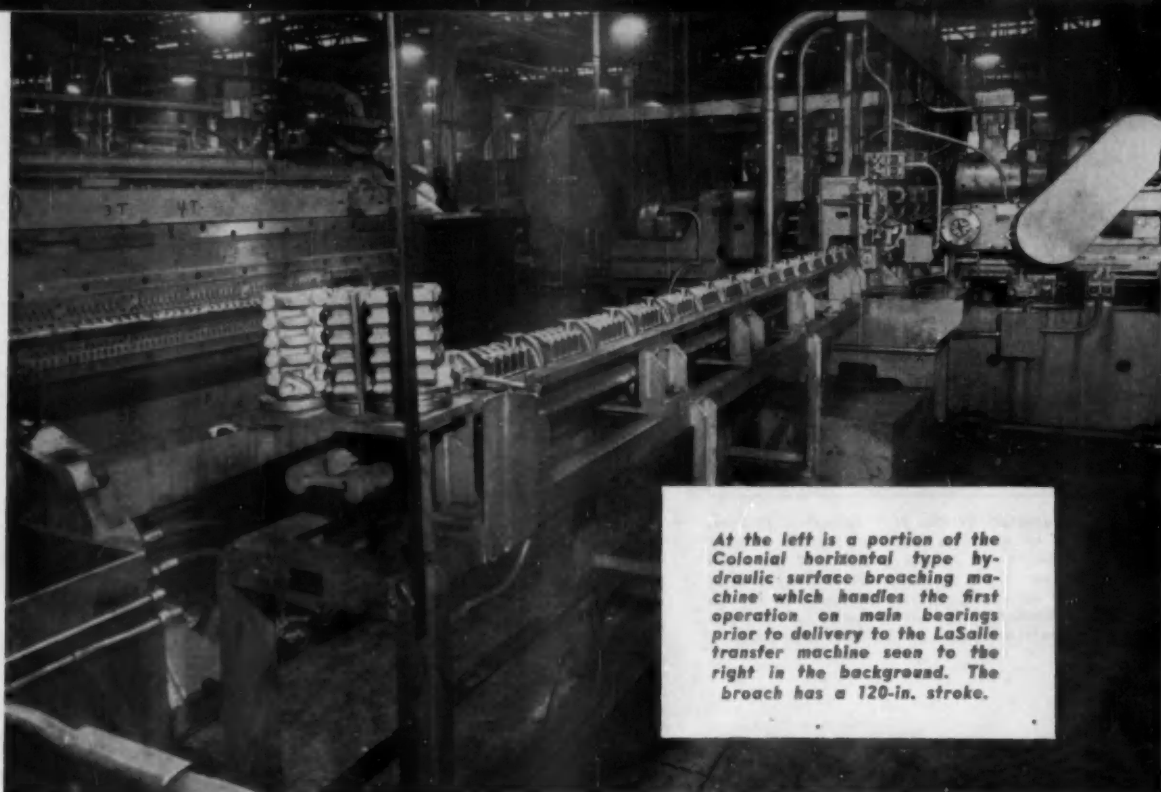
is a long steel plate running edge-wise on rollers and bored with holes to correspond with the cylinder induction ports. Movement of the plate determines the size of the throttle opening, and this is actuated by rack and pinion gear-

ing coupled to the accelerator pedal.

Joseph Lucas Ltd., after investigating fuel injection for both aircraft and cars during the past 15 years, is now developing less costly equipment suitable for com-

mercial application. Lucas has a licensing agreement with the Holley Carburetor Co. of Detroit covering the exchange of patents, engineering knowledge and data on automotive fuel injection systems based on the Lucas patents.

The basic Lucas shuttle piston fuel injection described and illustrated in *AUTOMOTIVE INDUSTRIES* Oct. 1, 1956, page 52, had a much simpler throttle arrangement than the one used on Jaguar competition cars. No doubt a design of this kind will be followed in producing a system which will be competitive costwise with one or two carburetors of the four-barrel type.



At the left is a portion of the Colonial horizontal type hydraulic surface broaching machine which handles the first operation on main bearings prior to delivery to the LaSalle transfer machine seen to the right in the background. The broach has a 120-in. stroke.

## Advanced Transfer Machine for Main Bearing Sets

**C**HRYSLER Division recently installed in its East Jefferson engine plant one of the most advanced, certainly one of the most compact transfer machines for the machining and cut-off of main bearing sets. The transfer machine, illustrated here, designed and built for Chrysler by LaSalle, runs some 45 ft in length and includes 20 stations.

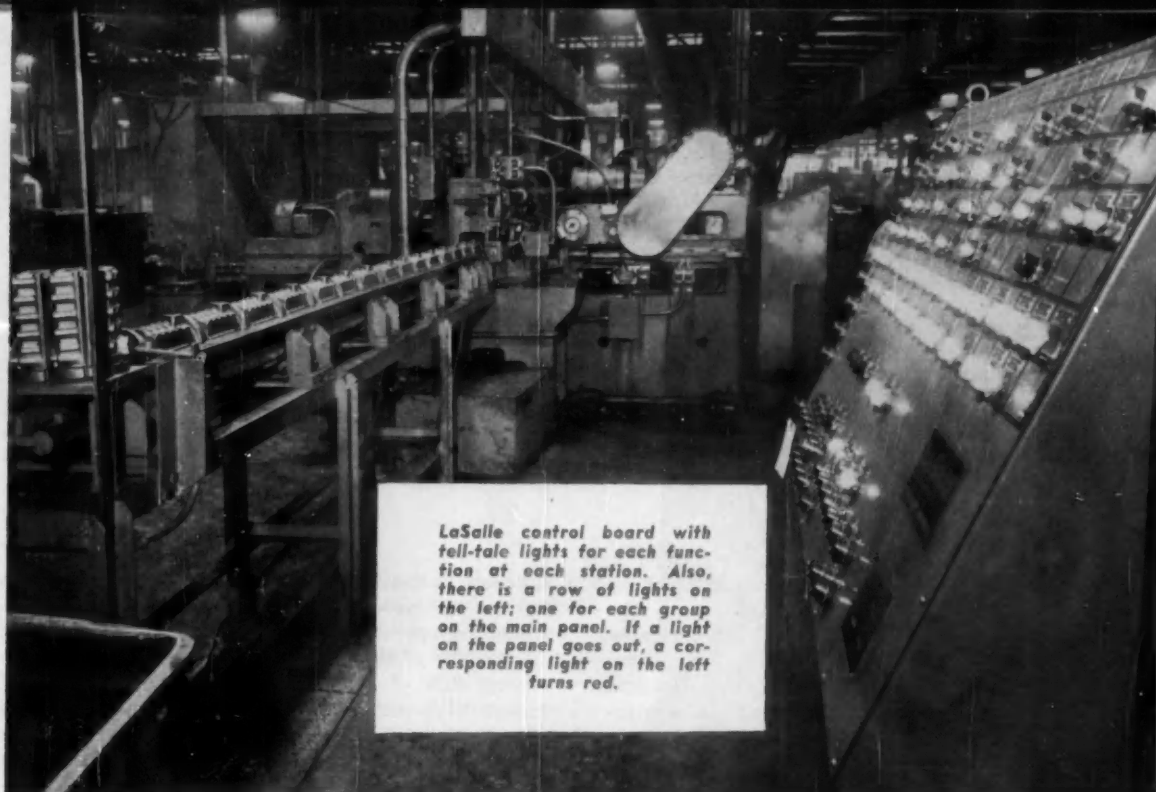
Besides automaticity and high productivity the LaSalle equipment has a number of interesting features. One of these is the special design of the base to accommodate its own self-contained chip conveyor. In addition, the machine is equipped with manifolding for coolant or cutting fluid, although the current job for which it is tooled is cast iron and is machined dry. The point is that if malleable iron castings were to be processed the necessary cutting fluid system could be activated. As a matter of fact, the process engineers intend to apply air to the manifolding and thus keep stations clean of chips when machining cast iron.

Another feature of advanced design is incorporated in the main control panel. As illustrated, tell-tale lights are supplied for each function for each station in the usual manner. In addition, there is a single row

of lights at the left, one for each group on the main panel. If any one or more lights go out on the panel, indicating trouble, the single light at the left corresponding to the affected row will turn red. Thus the operator needs only to scan the single row of lights at the left rather than the entire battery of lights.

As is customary, the set of five main bearing caps is produced enbloc for easy handling as well as for better matching of sets. Before coming to the LaSalle machine, the blocks go through the Colonial horizontal type hydraulic surface broaching machine for the following group of operations: rough- and finish-broach the joint face, rough- and semi-finish-broach the block fit channel, rough- and semi-finish-broach the half-round through the block. One piece is handled at a time with manual loading and unloading. At the unloading end, however, the operator loads the finished pieces into an automatic conveyor for transport to the LaSalle machine. Incidentally, the Colonial broach has a stroke of 120 in. and it too has been equipped with manifolding to supply coolant if malleable parts are processed.

Transport from the Colonial broach to the LaSalle



LaSalle control board with tell-tale lights for each function at each station. Also, there is a row of lights on the left; one for each group on the main panel. If a light on the panel goes out, a corresponding light on the left turns red.

machine is by means of an automatic shuttle type loader, 14 ft long, supplied by LaSalle. It is arranged to feed at twice the cycle time of the transfer machine to keep the pipe line full. Following is a summary of the operations at each station:

Station	Side	Operation Name
1	End	Load automatic
2	RHS	Mill ends of cluster
3	LHS	Drill 4 bolt holes No. 3 & 5 caps—2 holes in each cap
3	LHS	Idle
4	LHS	Drill (4) bolt holes—Ream 2 bolt holes No. 1-3 & 5 caps—2 holes in each cap
4	RHS	Mill O/P pad No. 5 cap
5	LHS	Drill 4 bolt holes—chamfer (1)—2-4- & 5 caps
5	RHS	Idle
6	LHS	Idle
6	RHS	Probe 9 holes 1-2-3-4-5 caps
7	LHS	Chamfer 9 holes 1-2-3-4-5 caps
7	RHS	Drill angle oil hole 1/2 way No. 5 cap
8	LHS	Ream 8 holes No. 1-2-4-5 caps
8	RHS	Drill angle hole to depth No. 5 cap
9	LHS	Idle
9	RHS	Idle
10	RHS	Idle
10	RHS	Spotface 6 holes 1-3-5 caps
11	LHS	Mill oil drain slot in No. 5 cap in 1/2 round diameter
11	RHS	Spotface 4 holes No. 2-4- caps
12	Both ends	Idle
13	LHS	Idle
13	RHS	Counterbore O/P hole in No. 5 cap—Combination drill and chamfer 2 screw holes in O/P pad
14	LHS	Mill (2) oil slots in joint face No. 5 cap
14	RHS	Line ream O/P hole (3 diameters)—Probe & blow (2) O/P screw holes
15	Both sides	Idle
16	LHS	Mill anchor slots No. 1-2-3-4-5 caps
16	RHS	Idle
17	Both sides	Idle
18	LHS	Idle
18	RHS	Tap (2) O/P screw holes
19	RHS	Idle
19	LHS	Saw into 5 parts
20		Unload automatically at end of machine

At Station 2 milling is done with cutters fitted with wedge type cemented-carbide blades, operating at 350 sfpm with feed rate of 16.03 in. per minute.

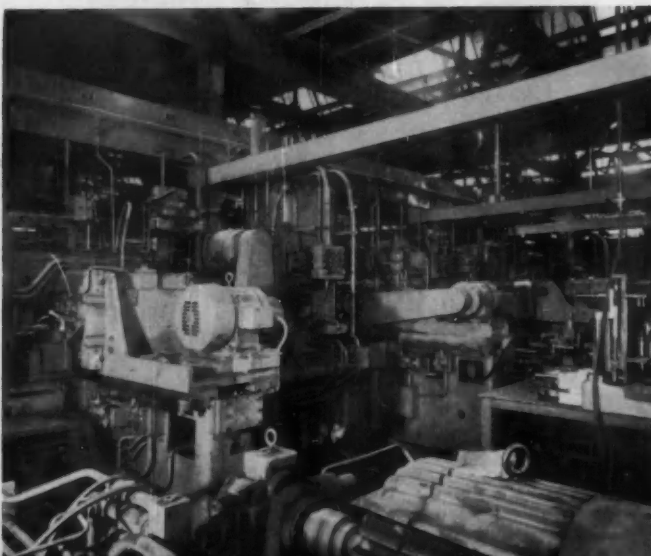
At Station 3 RH, the four drilled holes are probed automatically to protect the cemented-carbide reamers used later.

At Station 4 RH, milling is done with a shell end mill, fitted with cemented-carbide blades, operating at 350 sfpm with 25.16 in. per minute feed rate.

Another automatic probe is employed at Station 6 RH on the nine holes to protect the reamers used later. Similarly a combination probe and blow-out is used at Station 14 RH, ahead of tapping.

(Turn to page 111, please)

View of the LaSalle transfer machine—stations 14-16—affords an idea of the variety of heads employed in this equipment.



# Automatic Machines at Oldsmobile

Camshafts Are Turned and Cylinder Heads Assembled with a Minimum of Operator Attention in the Oldsmobile Engine Plant

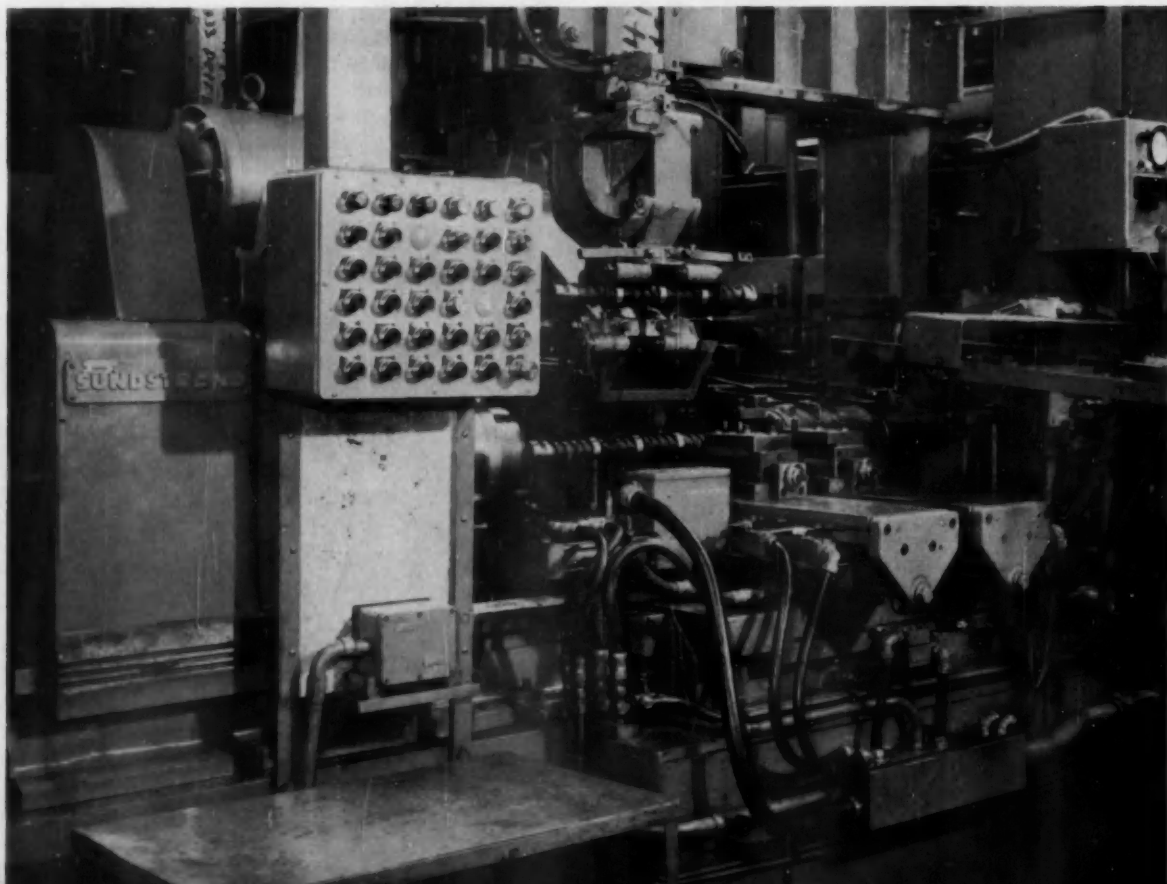
**M**ANY important developments are in the making in the Oldsmobile engine plant. Among the most noteworthy are some automatic assembly machines, one of which is described here. In addition, this article covers the details of a fully automatic process line for the machining of cast camshafts without operator attention.

Oldsmobile has two similar lines of camshaft turning machines, each consisting of eight Sundstrand

automatic lathes tied together by means of conveyor sections linking one machine to the next. In the sequence of operations, the objective is to subdivide the variety of operations so as to permit the most efficient flow of work from start to finish. The sequence, with each station representing an automatic lathe, is notated, across the top of the opposite page.

It will be noted that the first four machines handle roughing operations while the last four are respon-

*Last station of Sundstrand camshaft turning transfer machine. It shows clearly the mechanism for loading and unloading the work by means of the arms seen in the center which are transferred from the extreme right to the loading station via the overhead rail. Finished camshafts are dropped into the chute at the extreme right and flow downward to meet the conveyor for transport to the next operation.*





**STATION NO. 1**

Rough turn No. 1 and No. 5 bearing diameter  
 Rough turn gear diameter  
 Face sides of gear  
 Chamfer No. 1 and No. 5 main bearings

**STATION NO. 2**

Rough turn No. 4 bearing  
 Rough turn gear fit and end flange  
 Chamfer and neck No. 4 bearing  
 Face gear fit diam.  
 Rough turn No. 3 bearing diameter

**STATION NO. 3**

Rough turn large diameter between gear fit diameter and No. 1 bearing  
 Straddle face flange  
 Chamfer and neck No. 3 bearings

**STATION NO. 4**

Rough turn No. 2 bearing diam.  
 Chamfer No. 2 bearing  
 Undercut gear fit diameter and No. 1 bearing diameter

**STATION NO. 5**

Finish turn No. 1 and No. 5 main bearings

**STATION NO. 6**

Finish turn No. 4 bearing diameter  
 Finish turn gear fit diameter

**STATION NO. 7**

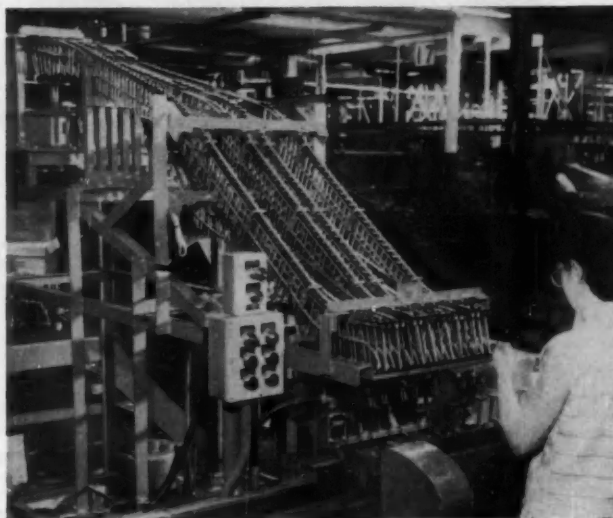
Finish turn No. 3 bearing diameter  
 Finish turn large gear fit diameter

**STATION NO. 8**

Finish turn No. 2 bearing diameter

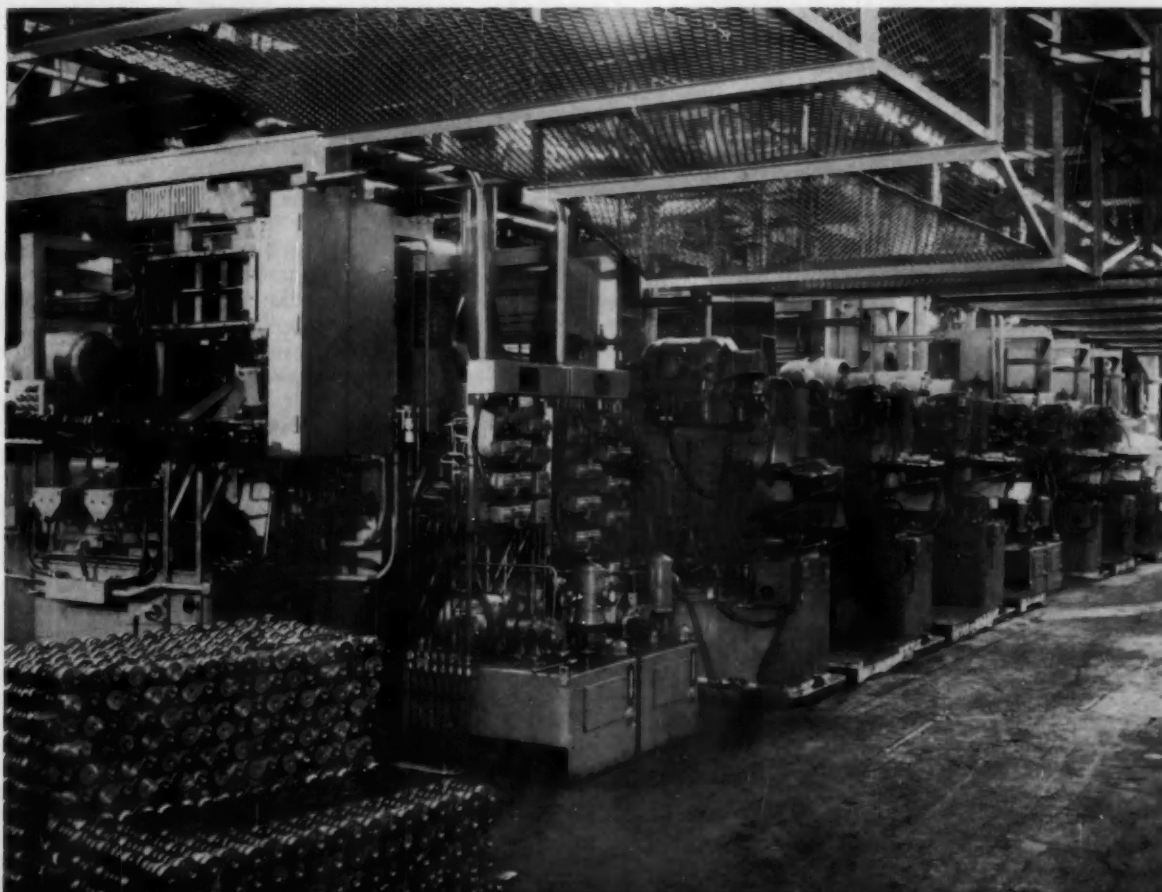
sible for finishing operations. Each of the first four Sundstrand lathes has a small panel board, showing a small sketch of the tooling. This is supplemented with calibration dials for each set of tools to indicate maximum usable tool life.

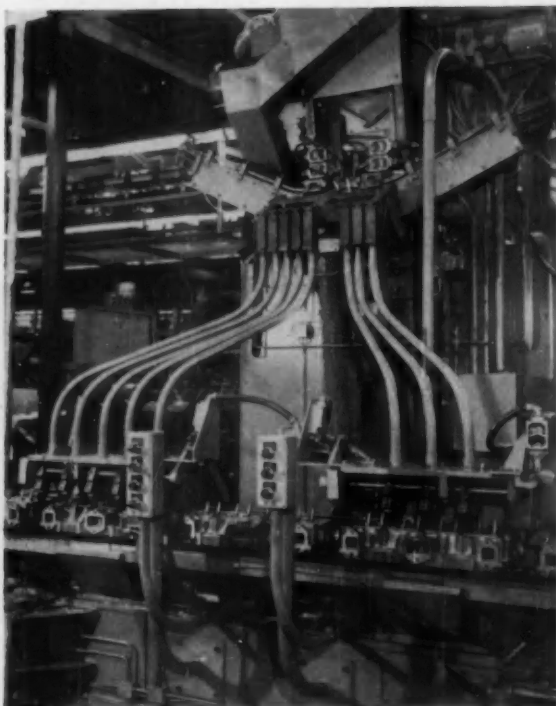
Each of the lathes on finishing operations, on the other hand, carries a Taft-Peirce automatic gage for verifying the tolerances at each point. A very high quality part is produced because the camshafts are



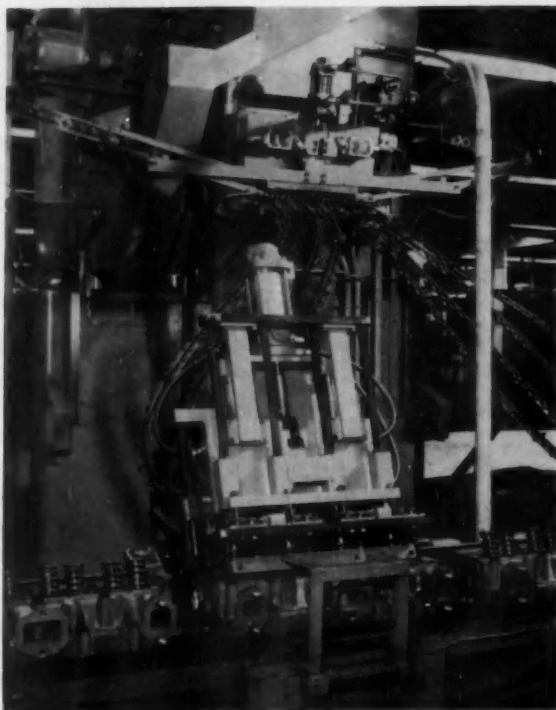
*Below is perspective of one of the Sundstrand camshaft transfer machines. Start of the operation is at the station at the left. Rough camshafts are loaded manually into the chute, from which point operation is completely automatic.*

*Cylinder head assembly machine, above, is an integration of a number of automatic stations, interconnected electrically, with the work moving on a connecting conveyor. This first station feeds valves to the operator.*





*This station feeds a group of five long bolts through the five tubes at the left; and a group of three short bolts through the tubes at the right. Overhead, in background, is the means for delivering the bolts to the tubes from the Feedall unit in the rear.*



*Spring retainers are fed to the heads and assembled automatically at this double station. Retainers for four springs are seen in the process of delivery down the chutes in center; four other chutes catch the remaining springs at the next station.*

chucked as close as possible to the bearing diameter being machined.

At the exit end of this line there is a belt conveyor, arranged at right angle to the machine line, which picks up the finished camshafts from the last machine and transports them to the end of the conveyor for further transport to the grinding department.

The method of transfer from one machine to another is quite noteworthy. Starting at the first machine, camshafts are loaded manually onto an inclined conveyor section, permitting them to roll down to the loading station of the machine. At this point the camshaft is gripped by a loading arm and at the proper time it is transferred on an overhead rail to the loading station of the machine. The loading arm is moved into a final position where the work can be engaged by a center at one end and a chuck at the other.

When the machining cycle has been completed, the

loading arm returns to the work station, grips the camshaft, raises it and transports it to the conveyor station where it is deposited and permitted to roll down to the next station.

This automatic loading and unloading cycle is repeated continually at each machine. At the end station, however, the camshaft is released and rolls down to the conveyor, mentioned earlier, for transport to the grinding operations.

The automatic cylinder head assembly machine is the first of a group of assembly machines being installed in the engine plant. A project of the Process Development Section at the General Motors Technical Center, the machine is some 137 feet long and with the exception of some repair stations is essentially fully automatic in action.

The operation begins at one end of the machine with the assembly of valves which are fed to the

### **Greyhound To Expand Car Rental Business**

Greyhound Corporation is jumping into the car rental business on a large scale. It has opened agencies in New York, Chicago, Detroit, Miami, and Cleveland and plans immediate expansion into all other major cities.

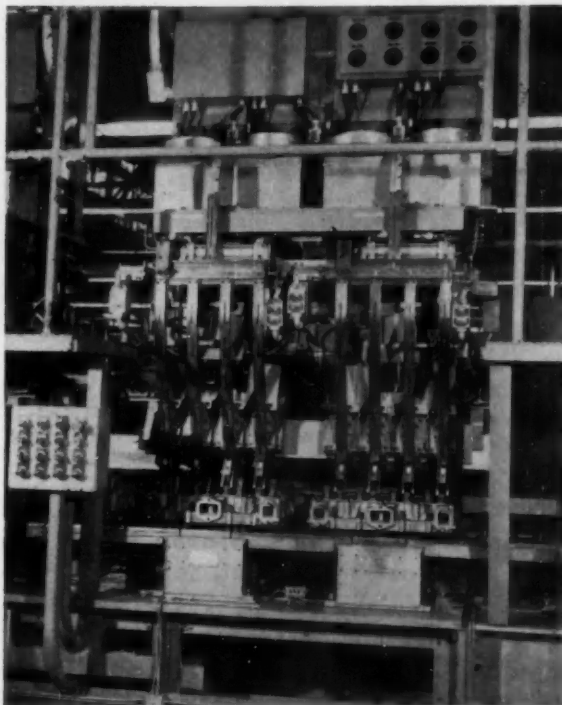
Greyhound started its rental business last March through a subsidiary, Greyhound Rent-A-Car, Inc. It already owns or has on order \$6 million worth of new 1957 cars. The company also has more than 9000 cars leased under contract for its fleet operation.

Contrary to industry practice, Greyhound will not charge customers an

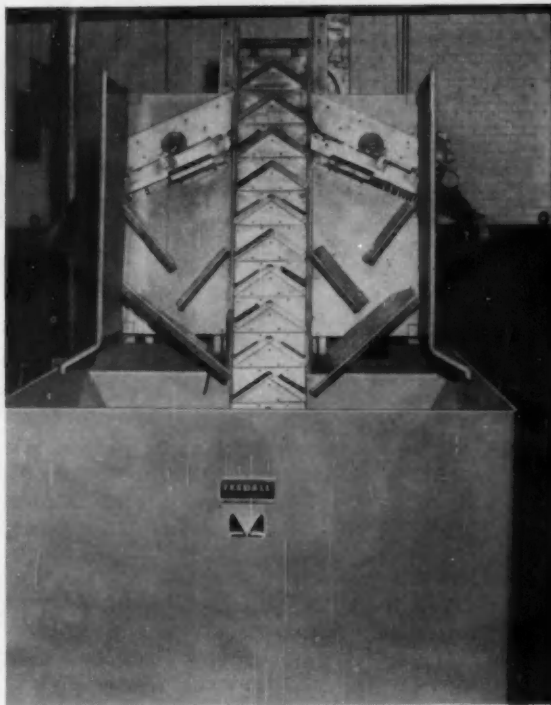
additional return fee for cars relinquished at stations other than the one from which they were rented.

### **Seiberling Doubles Output Of 14-in. Tires For Cars**

Now that tire producers are well into production on 14-in. tires for the original equipment market, plans are



Retainer keys are delivered to this double station and assembled in place automatically.



Typical of the several special Feedall hopper and sorting units installed on the cylinder head assembly line is this one on the station for feeding of long and short bolts. In the center is the endless conveyor which picks up bolts from the hopper below, transfers them to the slides on each side, at the top, where each one enters the cartridge belt that feeds the chutes in front.

operator's station along the chutes, as illustrated. Following this is an automatic turnover station, indexing the head for succeeding operations.

From this point on the various stations along the line may be listed as follows:

#### STATION SEQUENCE

- Load spark plug gaskets
- Load spark plugs and drive in place
- Feed a group of five and a group of three long bolts
- Drive two lower studs
- Drive two upper studs
- Drop four short bolts
- Drive pipe plug
- Load oil deflectors onto valve stems
- Load valve springs
- Load eight spring retainers
- Load keys at two stations
- Automatic inspection device to check loading of keys

It is of interest that at a number of stations where parts such as the bolts and retainers are fed to the station, the feeding is done from a Feedall hopper mechanism in which the parts are picked from the

hopper by means of a special flight conveyor and directed into chutes for transport to the loading station.

There are a number of so-called repair stations following the inspection station to take care of assemblies that may have failed to pass acceptance for any cause. It is quite likely that even this handling will be practically eliminated after this rather intricate machine has become properly tuned to the pace of daily productivity. It is estimated that the machine is capable of maximum output of 400 cylinder heads an hour when operating at full efficiency.

Finally, attention is drawn to the large control panel at the exit end of the machine. This is provided with signal lights for each station, making it possible to follow the successive stages of the operation and to note any misbehavior as indicated by a red light.

under way to accelerate production for the replacement market that lies ahead. Seiberling Rubber Co. has announced that it is doubling its production of the smaller tires. It is making them available now with nylon cord, in addition to the rayon fabric type which it has been producing.

#### U. S. Car Makers Keeping Eyes On Small Car Market

Automobile companies are carefully watching Volkswagen sales rise and are trying to detect whether a trend toward smaller cars is developing. The Big Three are reviewing small car plans, but at the moment appear con-

vinced volume possibilities are not great enough to warrant any definite action.

One phase of present studies is a small car design acceptable to both the foreign and U. S. markets. Particular interest lies in one which could be built in plants the companies have abroad and imported for sale here.



# Annual Meeting of the SAE

By Charles A. Weinert

**N**UCLEAR energy and fuel injection were among the topic highlights of a well-rounded program presented at the Annual Meeting of the Society of Automotive Engineers. Subjects of the 61 papers given in 24 technical sessions also included Diesel engine developments, small aircraft turbines, fuels and lubricants, cast crankshafts, seals, and automotive and aviation operational studies.

In addition to the technical sessions there were three luncheon meetings; the annual business session; and the annual banquet which took place in Detroit Masonic Temple. The vast program additionally encompassed 55 administrative, activity and technical committee meetings. Also of much interest was an all-day tour to the Aeronautical Laboratories of the University of Michigan. Another attractive feature of the program was a display of products by many of the component and material suppliers.

Held in Detroit's Sheraton-Cadillac and Statler hotels the week of January 14, it is no wonder that SAE's first 1957 national meeting drew an attendance of some 5500 management, engineering and production executives from the automotive industries.

Announcement of the election of W. Paul Eddy as 1957 SAE president was made at the annual business session. He is chief of engineering operations of Pratt & Whitney Aircraft Div., United Aircraft Corp. Other principal offices were newly filled at this meeting as detailed in the accompanying list of 1957 officers.

Dr. L. R. Hafstad, vice president, research staff, General Motors Corp., spoke on the subject of "Basic Research and the Automotive Industry" at the luncheon meeting held on the opening day. He said there was a tendency to neglect or overlook progress in other fields of endeavor, and that the biggest source of advance could be from other fields of research, rather than from improving existing fields. He cited atomic energy and transistors as developments outside normal channels; also the application of organic chemistry by Thomas Midgley in the development of high compression engines. The automotive industries should, in his opinion, explore and look into developments outside the industry. More emphasis should be placed on chemistry. There are very few in the industry who are "breaking the trail" creating new areas of knowledge in the field of statistics. Systems engineering is only in the embryonic stages, to mention examples falling in this general category. He cau-

## Fuel Injection Systems and Nuclear Powerplants Are Among Interesting Subjects Discussed at 24 Technical Sessions

tioned, however, that basic research was the prime responsibility of universities and specialized research groups. Industrial research groups should have as a principal goal "more products at less cost"—keeping management informed of new developments, and doing a reasonable amount of basic research to keep industry "young, open-minded and aggressive."

### ENGINEERING DISPLAY

**T**HIS year's engineering display, comprising 79 exhibitors and 90 booths, featured the most recent developments of leading automotive suppliers, including makers of aircraft components. Representative of the wide variety of products exhibited are the following:

Continental Motors Corp. had on display an aircraft engine of 240 bhp at 2600 rpm and a six-cylinder Diesel engine of 172 hp at 2400 rpm. Lord Manufacturing Co. demonstrated various designs of molded rubber mountings for engine vibration damping. The Kelsey-Hayes Wheel Co. displayed a number of units, such as power brakes, and described the Udimet vacuum furnace for melting and casting high temperature alloys for turbine blades.

Schwitzer Corp. exhibited its line of fans and pumps, including a new modulated fan drive. Reynolds Metals Co. had on display numerous automotive items in aluminum, including a transmission housing, grille, quarter trim, air conditioning evaporator, and a forged wheel. Bendix Aviation Corp. displayed its Electrojector fuel injection system, and newly-announced Scinseal protective coatings for wiring assemblies.

The elastomers Div. of E. I. du Pont de Nemours



and Co., Inc. showed the use of white Neoprene in white sidewall tires, black Neoprene in tire curb strips, Hypalon in weatherstripping and drip molding and for spark plug boots, and Urethane foam in crash pads, armrests, and heater housing. The Du Pont Plastics Div. showed Teflon, Lucite, Zytel, and Butacite applications. Hercules Motors Corp. showed a four-cylinder and a six-cylinder gasoline engine, with four-cylinder and six-cylinder Diesel engines interchangeable with them. A three-cylinder Diesel engine was also on display.

Aluminum Company of America exhibited samples of anodized aluminum trim, grilles, escutcheons, forged wheels, die cast aluminum transmission housings, pistons, transmission stator, etc. Ross Gear & Tool Co., Inc. displayed integral power, semi-integral power, and power linkage steering units, and a new directional signal. Another new item was a heavy duty steering gear made in aluminum to save weight, and also a new model for light duty. Lipe-Rollway Corp. offered a group of heavy duty clutches; and the new STM unit, responsive to speed and torque, for limiting output shaft speeds to desired leveling off points despite increasing higher speeds of the prime mover.

The Al-Fin Div. of Fairchild Engine and Airplane Corp. showed bimetallic brake drums, aluminum pistons with Ni-Resist ring groove inserts, and an aluminum wheel with integral steel spider and cast iron drum liner. American M.A.N. Corp. displayed a 260 hp Diesel engine. Vickers Inc., displayed several power steering mechanisms and power steering pumps from its newly-formed Automotive Products Div., and several types of control valves from its Industrial Products Div.

LaSalle Steel Co. demonstrated its new Fatigue-Proof high strength steel. Wyman-Gordon Co. showed specimen forgings in steel, aluminum, stainless steel, titanium, and high temperature alloys. Kaiser Aluminum & Chemical Sales, Inc., had on display a new type of die-cast automobile wheel, made of aluminum and having an integral hub and drum. The rim is of the demountable type, held in place with clamps. Improved heat dissipation and light weight are featured. Other products displayed by this company included an aluminum automotive heating coil.

### TECHNICAL SESSIONS

**T**HERE is no foreseen possibility of direct nuclear propulsion of automobiles and trucks, according to C. R. Lewis, of Chrysler Corp., who reported on the findings of the SAE Nuclear Advisory Committee. Unless a revolutionary scientific principle is discovered, nuclear powerplants will always remain much too heavy for such applications. An optimistic estimate of the weight of a powerplant needed to propel a 3000 lb automobile is 80,000 lb, he explained. If, however, an efficient means of storing energy were



W. Paul Eddy, 1957 SAE President

to be invented, indirect propulsion of automobiles from nuclear generated power would be attractive. Dr. Lewis also reported of possible major importance the application of radiation to hydrocarbon processing. He pointed out that many of the major oil companies were already working in this field. Complete results have not been released as yet, but it is said that octane has been successfully formed from butane by radiation. It is also known, he stated, that polymerization of some plastics can be induced by radiation; and that irradiated polyethylene shows increased mechanical strength and heat resistance over unirradiated material.

The fact that LPG fueled buses have met with the entire approval of the Chicago Transit Authority was evidenced in a report by S. D. Forsythe of the CTA. Saying that this conclusion was based on 169 million miles and over six years of operation, he listed 19 advantages. These include trouble-free operation for 200,000 miles without engine rebuilds, triple the mileage between oil changes, decreased carbon formation, and improved life carburetors, spark plugs and mufflers. He also pointed out that the buses are exhaust smoke and odor free; even on units which have been in operation continuously for the past six years without a re-ring or engine rebuild. The safety record of this operation was also stressed. Mr. Forsythe indicated that by engineering safety into the installation, and by making periodic inspections of the mechanical

components and operating practices, this had been held to a very high level. He added that for successful operation from the economic standpoint, the potential user should investigate the cost differential between LPG and other fuels in his own particular area. "The propane engine with comparable power characteristics of a Diesel engine will require more fuel per mile. CTA's record by actual, precisely controlled tests indicates that 25 per cent less miles per gallon on propane can be expected," he explained.

During a session in which the relative merits of cast versus forged steel crankshafts were discussed, H. F. Wood, Wyman Gordon Co., mentioned that forged steel offered several advantages. He cited among these a combination of excellent mechanical properties with maximum uniformity from crankshaft to crankshaft and from section to section of the same crankshaft. And pointed to the maximum concentration of grain structure and fiber formation in critical areas. No crankshaft should be made without proper fillets, Mr. Wood said, is recommending extreme care in machining to produce full radii free from grinding marks. He suggested that in basic design the r/d be not less than 0.05-in. to avoid excessive stress concentration; in which "r" is the fillet radius and "d" the bearing or pin diameter. Mr.

Wood further mentioned that the use of rolled or shot-blasted fillets on heavy-duty crankshafts increased the endurance limit from 25 to 30 per cent, at small added cost.

H. N. Bogart and H. C. Grand described the shell molding process for cast crankshafts being used at Ford Motor Co., in which the shell molds are made of resin and sand. They reported ability to hold castings to close limits, long pattern life, clean castings, reduction in sand consumption, and ease of machining. Also that the nodular iron utilized has good damping characteristics and wear life.

K. B. Valentine, Pontiac Motor Div., told the meeting that dynamometer tests and road tests had shown comparable endurance of forged steel and cast pearlitic malleable iron crankshafts. He reported definite machining economies had resulted from the use of the pearlitic malleable iron. Mr. Valentine added that preliminary investigation had indicated that for the same hardness level, oil-quenched and tempered pearlitic malleable iron possesses slightly better fatigue properties than air-quenched and tempered material. A marked increase in fatigue properties of pearlitic malleable iron was indicated in recent early tests of the effect of cold working by coining, he said.

As a matter of passing interest, it might be men-

#### EXHIBITORS IN ENGINEERING DISPLAY

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American Bosch Div.  
American M.A.N. Corp.  
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Appel Process Inc.  
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Long Manufacturing Div.  
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Cleveland Graphite Bronze Co.  
Consolidated Electrodynamics Corp.  
Continental Motors Corp.  
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Detroit Controls Corp.  
Dow Chemical Co.  
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Dueloc Drive, Inc.  
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Enjay Co., Inc.  
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Al-Fin Div.  
Fram Corp.  
Garrett Corp.  
AirResearch Industrial Div.  
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Higbie Manufacturing Co.  
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Hoof Products Co.  
Johnson Bronze Co.  
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Fulton Syphon Div.  
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Ross Gear & Tool Co., Inc.  
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Schwitzer Corp.  
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Westinghouse Air Brake Co.  
Le Roi Div.  
Woodall Industries, Inc.  
Wyman-Gordon Co.  
Zollner Corp.

tioned at this point that the session on fuel injection "took all honors" when it came to attendance. Playing to an audience which filled to capacity the Grand Ballroom of the Sheraton-Cadillac Hotel, the General Motors fuel injection system and the Bendix Electrojector fuel injection system were capably described by the authors of this group of papers.

Interest in small gas turbine engines for aircraft, missiles, helicopters, boats, target drones and stationary applications was well in evidence at a symposium devoted exclusively to developments in this field. The emphasis was on cost reduction with adequate performance. W. E. Skidmore, of Boeing Airplane Co., described some of the highlights of a development program which began with a laboratory engine first operated in 1946, to the 240-hp gas turbine now in production. During this 10-year period the power output has doubled, the specific fuel consumption has decreased from 1.8 to 1.0 lb/hp/hr, and the weight has increased from 220 to 320 lb. Service life and cost in production quantities is approaching that of reciprocating engines, he further reported. Sumner Alpert, of Solar Aircraft Co., concluded that there are many current and potential applications where the small gas turbine can compete with other forms of powerplants. He said that the problems fall into two major areas—a simplification of controls and accessories, and reduced costs. Dr. Anselm Franz, of Lycoming Div., AVCO Manufacturing Corp., in discussing the development of the T53 engine, made an interesting observation. He said that the design of the blades of the five-stage axial compressor permitted selection of 403-type stainless steel having a relatively low hardness level to safeguard against impact failures and to avoid stress corrosion cracking. The success of this design in avoiding compressor blade breakage was illustrated by a photograph of a compressor rotor after having "swallowed" a chunk of magnesium about 2 by 3 by 0.3 in. The blades were twisted and bent, but not a single blade broken.

Automatic transmissions were represented in the program by two papers. One by S. D. Jeffe and B. W. Cartwright of Chrysler Corp. described in detail the TorqueFlite transmission. The second paper gave a description of the design and operation of the Chevrolet Turboglide transmission; and was prepared by F. J. Winchell and W. D. Route, Chevrolet Motor Div., and O. K. Kelley, GMC engineering staff. Much of the basic information on the latter unit was contained in *AUTOMOTIVE INDUSTRIES* for January 1, page 56.

The best way to effect a major reduction in ring and cylinder wear is to keep the oil clean and the cylinder walls hot. Present-day filter and cooling system designs are not adequately doing this job. These statements were advanced in a paper presented by H. R. Jackson of Atlantic Refining Co., in recounting wear measurement tests on 12 cars of two makes. A radioactive cast iron top compression ring was installed in each car. The cars were equipped with oil filters and oil bath air cleaners; oil and oil filters were changed every 5000 miles. Under the test conditions it was found that about 50 per cent of the wear

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O. A. Brouer, Auto. Div., Swift & Co.; W. K. Creson, Ross Gear and Tool Co., Inc.; and A. W. Denny, Goodyear Tire & Rubber Co. of Canada, Ltd.

was due to oil-borne abrasives, about 45 per cent due to low temperature corrosion, and about 5 per cent to other causes. While admitting that present-day oil filters reduce wear appreciably, the author felt there was still room for considerable improvement. Corrosive wear above 160 F cylinder wall temperature was found to be negligible. The fact that prevailing temperatures exert a pronounced effect on wear rates is ample evidence, he said, that cooling systems do not permit either rapid warm-up or adequately high inlet water temperatures after warm-up.

The development of the Continental AVDS-1790 Diesel combat-vehicle engine was thoroughly outlined in a paper by H. H. Haas and E. R. Klinge of Continental Aviation and Engineering Corp. It is a 12-cylinder, 90-deg vee, four stroke cycle, aircooled type, turbocharged, and both bore and stroke are 5.75 in. for a total piston displacement of 1790 cu in. Design details of the engine are given elsewhere in this issue.

Results of a survey on spark plug fouling were given in a paper co-authored by C. A. Hall, R. C. Beaubier, E. C. Marckwardt and R. L. Courtney of Ethyl Corp. The survey disclosed a considerable degree of spark plug fouling exists in vehicles driven in city and city-suburban service. In checking 193 late-model cars of four popular makes, about one-third of the spark plug sets were fouled sufficiently to cause at least a 20 per cent decrease in performance. It was



said that dynamometer and road-test procedures have been devised for studying the various factors involved. Instrumentation has been adapted which continuously records spark plug misfires by measuring pressure fluctuations in the exhaust system. These studies showed that changes in the hydrocarbon composition of fuel base stocks, fuel sulfur content, and antiknock-compound formulation can affect spark plug fouling. The large effect of changes in the composition of the fuel base stock indicates an important area for future research. It was also learned that phosphorus fuel additives offer a commercial solution by at least doubling the mileage to spark plug fouling.

The benefits of increasing compression ratio beyond a certain point are definitely subject to the law of diminishing returns, J. C. Hughes of Continental Oil Co. reported. He based this contention on an investigation, conducted with a special single-cylinder test engine, of compression ratios ranging from 4:1 to 16:1 and quench areas from 0 to 50 per cent piston coverage at each compression ratio. It appears safe to predict, he said, that beyond 13:1 compression ratio, nothing exists but a high fuel antiknock requirement and a host of new and complex problems. The latter including "run-away" pre-ignition, extreme sensitivity to ignition timing, and engine roughness. The added cost of high-octane fuels cannot be economically justified by the gains in power and thermal efficiency obtained. Quench area, in the range investigated, had no effect on power or thermal efficiency; but he informed the group that quench area can be used to lower an engine's antiknock requirements and increase its appreciation of sensitive fuels.

Automation was not overlooked in this expansive program. A rather interesting presentation was made by G. H. Amber and P. S. Amber, machine control consultants, entitled "A Yardstick for Automation." They set forth a method of classifying the various forms of automaticity based on the type of "energy" used and, mainly, the source of "information" used for control. As an illustration of the latter, the fifth order of automaticity would be one in which a computer in the machine's functional control system or program control system would respond to a mathematical function of either the control or feedback signal. They visualized the next big step in automatic machinery would involve machines in this category that would "think" for themselves in performing operations. For instance, a punch press might automatically position the stock so that the maximum number of parts could be stamped out of a minimum of stock. Or, a machine tool with a built-in automatic machinability computer might remove metal at the fastest permissible rate, taking into account the tool, surface speed, material and other machinability variables even if they were continually changing. They also suggested the possibility of parts handling being expedited, with minimum modification needed for part changes, by utilizing military fire-control practices to sort and position parts by selective controlled catapulting. By means of this "aerial transfer" system, parts in process would be "lofted" for three-dimensional positioning; or "kicked" across a free surface table for two-dimensional positioning.

Extracts from some of the outstanding papers follow:

## Experimental Stress Analysis in Small Turbines

By Gordon Sorenson

Continental Aviation & Engineering Corp.

**T**HE small gas turbine is fertile territory for experimental stress analysis. It provides the opportunity and a challenge for the experimental stress analyst to apply all of the knowledge available for the analysis and control of some very complex load and stress systems.

In the small turbine as in most structures the original design is a trial solution. In some fields of engineering where weight is not a penalty, the analytical methods produce trial solutions which are nearly always adequate. In structures which transmit as much energy per pound of material as do small turbines, analytical methods do not produce adequate structure on the first try and in the not-too-distant-past the endurance testing of engines was the only means of developing a satisfactory structure. At Continental, experimen-

tal stress analysis is filling the gap between the designer and endurance testing of engines.

### High Frequency Test

High frequency stress is usually a resonant vibratory stress caused by a mass spring system excited by a fluctuating force system. The mass spring systems requiring the most experimental testing are the turbine and compressor blades and disks. The specifications for test equipment to measure stresses on turbine blades during engine operation are as follows:

A strain gage that can be bonded to the surface of metal and measure dynamic strains at frequencies up to 15,000 cps in the presence of 80,000 Gs, 1350 F metal temperature and with sonic velocity gases passing over it. The electric signal must be passed

from the rotating member which is spinning at over 20,000 rpm through slip rings with less than 100 microhms contact resistance to instruments which will record the millivolt signal and analyze the various frequencies of which it is composed. Analysis of the testing problem indicates that the major hurdles are a strain gage to operate in this environment and a slip ring to maintain almost perfect contact with the gage.

In order to develop instrumentation in a short time and at minimum cost, the first gage installation of a wire grid type (NACA) and a nine-ring slip ring (Bean HS-9) were purchased. In Continental turbines, it is most convenient to mount the slip ring at the turbine end of the machine. This means that the device must be shielded from hot exhaust gases. The installation was accomplished by using a chrome-plated radiation shield, which provides a 50 per cent decrease in temperature. The housing incorporates two one-fourth inch air lines. Another air line carries filtered air into the body of the slip ring, reduc-



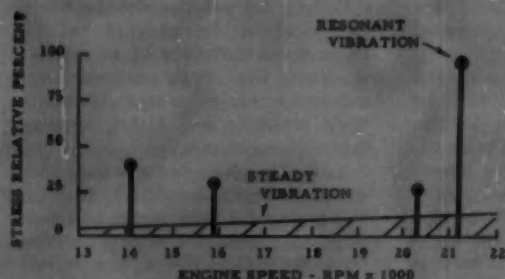


Fig. 1—Turbine blade stresses in original design

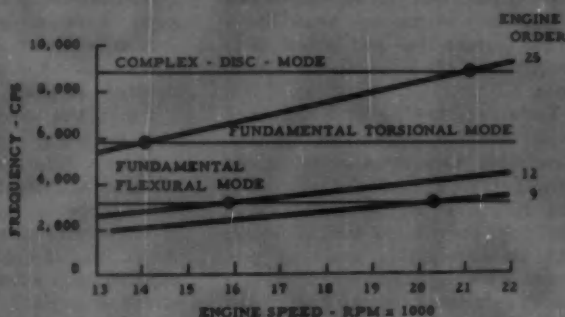


Fig. 2—Critical speed diagram in original design

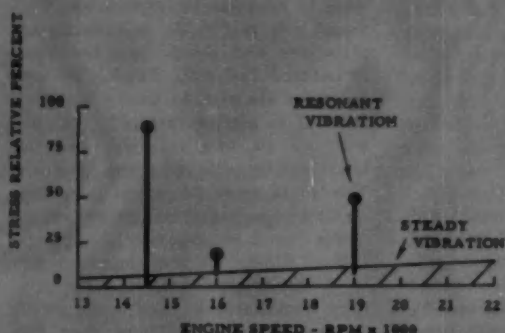


Fig. 3—Turbine blade stresses in modified design

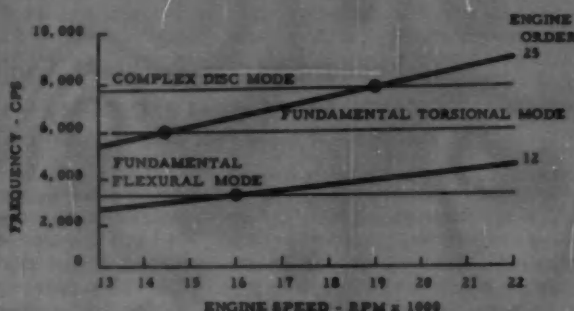


Fig. 4—Critical speed diagram in modified design

ing the temperature of the slip ring to 130 F. Early experience with the wire grid strain gage indicated a basic weakness at the junction of grid to lead.

Current testing is being done by using the foil gage and the techniques reported in Vol. II, No. 2 of Testing Topics, which is published by Baldwin-Lima-Hamilton Corp. Good results are obtained using the  $\frac{1}{8}$ -in., 66-ohm gage in a series or ballast circuit requiring two slip rings per gage.

After conducting a number of rotating vibration surveys to measure vibratory stresses, it has become apparent that several variables must be considered in order to control high frequency vibratory stress.

Engine speed at which resonance occurs is the most important variable, as tests have shown that few blades will have an acceptable fatigue life if resonance occurs near a steady operating speed. This is understandable when it is realized that as much as a

20 to 1 change in the amplitude of the vibratory stress is caused by resonance. There are always several resonant points in the speed range of an engine plus continual forced vibration and small sporadic resonant points. The fluctuating force or the principal source of excitation is the turbine inlet nozzles. The first order of the inlet nozzles is the one usually causing the largest stress; however, harmonics of the nozzles can cause resonant vibration as well as struts, combustion chambers, and other parts disrupting the air flow. Figures 1 and 5 are typical plots of vibratory stress vs. speed, showing only major resonant points and the average steady vibratory stress. Figures 2 and 4 show interference diagrams of frequency vs. rpm, giving the mode of vibration and the source of excitation, which shows that the two largest resonant points are caused by the 25th order, which is the number of inlet nozzles. The vibratory stress for the wheel shown in Fig. 1 had the

highest resonant vibration near the operating speed. Changes in the design shifted the natural frequency of the wheel downwards, which resulted in over a 5 to 1 reduction in stress at the operating speed, Fig. 3. Endurance tests indicated at least a 20 to 1 increase in life for the modified designs.

Prior to engine testing, sufficient test data is not available to say how far from operating speed resonant vibration should be for a given amplitude. These limits can be set with further testing. Experimenters all seem to agree that the speeds at which resonance occurs are impossible to predict for complex modes of blades and disks and only simple ones of fundamental blade bending and torsion as excited by inlet nozzles, struts, combustion chambers, etc., are predictable. Predicting magnitude of the stress is impossible for all resonant points because of the complexities that govern energy input and damping. (Continued)

Predicting the life of blades after stress measurements are made can be done only within very broad limits at the present time and is limited to comparison of different configurations.

Endurance testing of wheels and experimental stress analysis are supplementing each other to obtain the desired life. If material properties and statistical vibratory data were available, the life of turbine rotors and blades probably could be predicted without endurance tests. As can be seen by comparing Figs. 2 and 4, the rotor in Fig. 4 has large vibratory stresses at high engine speed where centrifugal stress is high and temperatures are high. By changing the design, the highest vibratory stress was moved to a lower speed

where centrifugal stress is much lower and the temperature is much lower. Considering only a stress reduction of 5 to 1 at high speed, the life of this rotor would be increased hundreds of times.

A statistical study of many designs and operating conditions will be necessary before the exact significance of load spectrum and temperature can be determined. The effects of temperature, cyclic stress, steady stress, and frequency will become apparent only after the fatigue properties of turbine materials become available in the form of Goodman diagrams for load cycles from 1 to  $10^6$  and the frequencies from 500 cps to at least 15,000 cps and at the operating temperature of the material.

## Turbocharging the Series 71 Engine

By J. J. May and V. C. Reddy

Detroit Diesel Engine Div., General Motors Corp.

A TURBOCHARGED two stroke engine is a difficult engine to rate. The rating possibilities are too extensive. Increased supercharging can be extended to a point that the engine becomes a gasifier with all the power of the engine available to the turbine. The turbocharger can readily be used to improve power and economy and less readily used to improve economy without changing the power output. In early tests we increased the output to approximately one horse power per cubic inch of displacement with satis-

factory fuel economy. It would not be difficult to increase both air and fuel and thus further increase output. Among the factors that finally decided the engine ratings were: engine life, startability, combustion peak pressures, thermal loading, cost, weight and available market. Higher engine speed was desirable since this permitted the use of existing torque converters and clutches whose torque capacity was limited.

The maximum rating finally decided on is shown in Fig. 1. This rating

maintained the fuel rate of non-turbocharged engines, provided a respectable improvement in power and economy and did not destroy the torque characteristic. In addition we felt there would definitely be no decrease in engine life. Peak pressures were not increased; exhaust temperatures were lowered; and piston temperatures were reduced.

Turbocharging, for economy only, was somewhat more difficult than turbocharging for both power and economy. After checking several combinations, the Elliott M-5 with a suitable nozzle and a high flow diffuser appeared to give the best overall results. The full load performance is shown in Fig. 2. The increase in power output is quite small but the improvement in economy is respectable. This model will readily fit in existing applications and should pay for itself in reduced fuel cost. Production unit injectors are used to obtain both ratings. The higher rating is obtained with 80 cu mm injectors and the lower rating with 70 cu mm injectors. The '80' injector, 80 cu mm per stroke at 2000 rpm is the highest output injector used in commercial applications. Ninety cu mm injectors are used in pleasure craft and for military installations. The question is frequently asked: Where does this increase in power come from? Fig. 3 shows a full throttle curve with 90 cu mm injectors. The increase in output at top speed is approximately 24 per cent. Of this 24 per cent, 14 per cent is obtained by a reduction in the blower drive ratio and the reduced pressure rise through the Roots

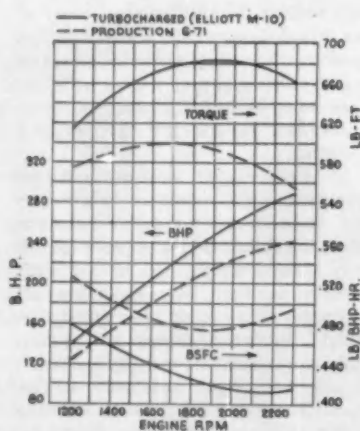


FIG. 1  
Model 6-71, full throttle, standard and turbocharged, 80 cu mm injectors. Maximum rating of turbocharged version for best all-around results.

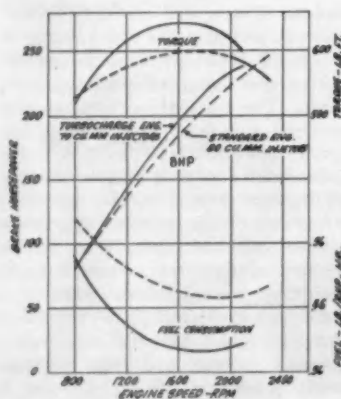


FIG. 2  
Model 6-71 with Elliott M-5 turbocharger and 70 cu mm injectors for best economy. Full load performance.

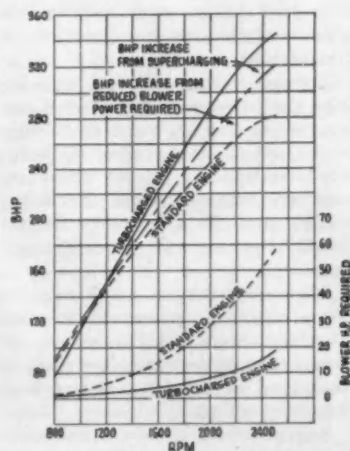


FIG. 3  
Full throttle performance, standard and turbocharged 6-71 with 90 cu mm injectors.

blower. The remaining 10 per cent increase in power can be considered the effect of increased supercharging. The effect of operation at a higher pressure level results in increased density of the trapped air, higher effective compression ratios, higher air fuel ratio and possibly improved scavenging. To what degree each of these various factors contribute to the overall gain has not been determined. While much of the increase in power output results from the decrease in power required to drive the Roots blower a still greater increase in power output would result if the Roots blower could be eliminated. This would be possible if the turbo-charger had an overall efficiency sufficient to maintain a high enough pressure differential across the engine throughout its entire load and speed range.

## Effects of Radiation on Materials

By Michael Ference, Jr.  
Ford Motor Co.

**A**LTHOUGH the effects of high energy radiation on materials have been the subject of study since the discovery of x-rays by Roentgen and of radioactivity by Becquerel at the turn of the century, this field received its greatest stimulus from the wartime research on atomic energy and since then by the availability of unusually intense sources of radiation both from reactors and particle accelerators.

### Effects on Metals

While the radiation defects produced by neutron bombardment of metals are confined to more or less localized areas, nevertheless under accumulated neutron radiation rather significant changes in the mechanical properties can occur. Many metals show an increase in hardness after irradiation, an increase in ultimate tensile strength and yield strength (particularly if the temperature of bombardment is low compared to the melting point), decrease in elongation and in the case of carbon steels an increase in fracture-transition temperature. On the other hand most metals show very small changes at room temperature in such properties as density and creep rates. Changes induced in some common engineering metals on irradiation with neutrons are summarized in the accompanying table.

PRE AND POSTIRRADIATION VALUES OF HARDNESS, AND YIELD AND TENSILE STRENGTH OF VARIOUS ALLOYS

	Rockwell Hardness No.		Yield Strength 10 <sup>3</sup> , Psi		Tensile Strength 10 <sup>3</sup> , Psi		Ratio of Yield Strength/Tensile Strength	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
25H14 aluminum	8F	40F	18	23	20	27	0.9	0.85
250 aluminum	—	—	7	17	173	26	0.51	0.65
High purity iron	—	—	18	31	36	37	0.5	0.84
Normalized carbon steel			50	93	75	97	0.67	0.96
Hardened and tempered alloy steel	—	—	153	196	164	198	0.93	0.99
Austenitic stainless steel	81B	99B	37	97	98	115	0.38	0.84

The permanency of the changes in properties of the crystalline solids produced by irradiation is dependent upon the temperature at which irradiation took place, subsequent annealing and the value of the integrated irradiating flux. Metals heated above their recrystallization temperature, eg., show no permanent effects.

Although the mechanisms of radiation effects are understood qualitatively, there is no satisfactory quantitative theory available for engineering calculations. Also, with the exception of a few materials there is a lack of comprehensive experimental data on the effect of intense radiation on metals. Broadly speaking, for large neutron doses hardness increases have been observed of about 40 per cent for carbon steels, 100 per cent for stainless, 140 per cent for nickel and 100 per cent for zirconium. Ultimate tensile strengths increases have been observed of 10 per cent for carbon steels, 20 per cent stainless, 40 per cent nickel, and 5 per cent for zirconium. At this writing there is no good experimental evidence that radiation will produce beneficial changes in the bulk properties of metals that cannot be obtained by conventional metallurgical methods.

### Vulcanization of Rubber

Vulcanization changes the natural rubber polymer from a soft, sticky, plastic to a non-plastic highly elastic substance. A single rubber molecule may consist of several thousand monomers (C<sub>2</sub>H<sub>4</sub>) joined end to end. The change in properties by vulcanization is brought about by cross linking these long rubber molecules by the presence of sulphur. The number of cross-links are relatively few, of the order of one per several hundred monomer units. The cross linking of the long rubber chain can also be induced by radiation with gamma rays

without the presence of sulphur. Here the cross linking is between carbon atoms rather than through sulphur-sulphur atoms. Bonds between the carbon atoms are stronger than those between sulphur atoms and it is expected, therefore, that radiation vulcanized rubber would be more heat stable than sulphur vulcanization. Smearing temperatures for gamma ray vulcanization of rubber and carbon black were about 500 F compared to 400 F for ordinary vulcanizates.

To obtain proper cures through radiation cross linking requires rather large doses, of the order of 50 megarads, and because of this very low g value is rather costly to produce. Although it is difficult to visualize radiation vulcanization of natural rubber for tires for passenger cars, irradiation may be justified in order to obtain valuable new properties in the case of synthetic rubber or to cold-vulcanize unusual shapes in situ.

### Summary

Radiation can produce significant changes in the properties of materials. However, there is a lack of fundamental data and theory to permit engineering calculation of the effect of radiation induced point defects on the bulk properties of metals. Furthermore, there is no obvious economic advantage at present to irradiate metals in the bulk for possible beneficial effects. Most plastics degrade rapidly in intense radiation fields, although in the case of polyethylene improvements in properties have been noted under moderate radiation doses. On the other hand, there is real promise in the use of radiation for initiating novel chemical reactions. For example, radiation grafted copolymers offer the possibility of a new class of engineering materials with prescribed properties.

(Turn to page 94, please)



# AUTOMATION NEWS REPORT

**AUTOMATIC CONTROLS**  
**PRODUCTION—VEHICLES—AIRCRAFT**

**By Samuel Cummings**

With industry getting ready to spend another record amount of dollars for new plant and equipment in 1957, the outlook is rosy indeed for makers of automatic controls. Most of the expanding industries in this country are large users of control equipment.

Continued sizable spending can be expected from the large continuous process industries—oils and chemicals—where the outlay for automatic controls is often as large as 20 per cent of new plant expenditures. And an equally sizable amount is likely from other industries, where the emphasis on automation continues to grow.

James D. Secrest, executive vice-president of the Radio-Electronics-Television Manufacturers Association, reports that the annual factory billing for products from the lusty young electronics industry approached \$5.9 billion in 1956, and is likely to exceed that amount by about 10 per cent in 1957. Almost half of the tab for 1956—about \$2.7 billion, he estimates—was picked up by the Government. This represents a gain of 10 per cent over 1955 sales of electronic military gear.

Sales of the instrument and control industry are estimated at almost \$1 billion, with the biggest gains being made in automation equipment. One of the most notable developments in the control field during the past year, says Mr. Secrest, was the sudden upsurge in the sales of transistors. About 13 million units were produced in 1956, compared with 3.6 million in the previous year.

While accurate figures are not available on capital investment in the electronics industry, largely because of its overlap in other industries, investments through purchase and mergers continued lively in 1956. The profit-and-loss picture, however, was somewhat blurred. Some companies increased their sales and profits substantially; others had good sales but a lower ratio of profits; still others—mostly in the TV field—experienced sharp declines in both sales and profits. But on the whole, says Mr. Secrest, the industry continued its dramatic rate of growth in 1956—a growth which many industry observers and economists believe is sparking the so-called second industrial revolution.

## ALTITUDE TEST CHAMBER

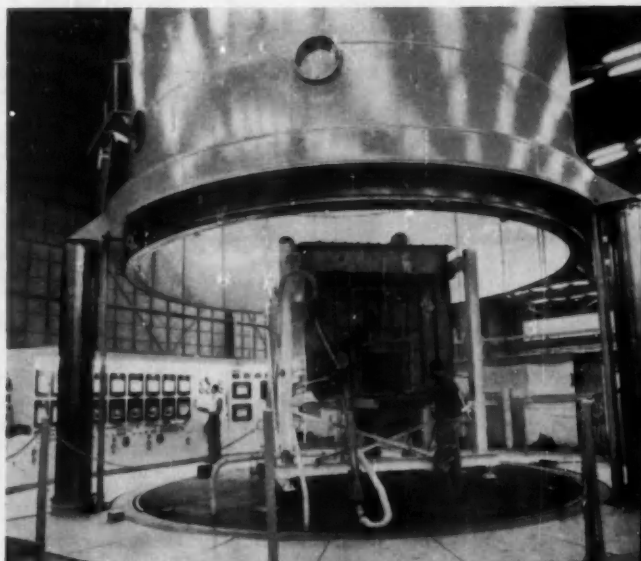
Complete flight sequences—from takeoff to stratospheric cruise to landing—can be simulated automatically in a new \$1 million altitude test chamber installed at the Tulsa Div. of Douglas Aircraft Co.

The chamber is composed of two sections. The top half, which holds the equipment to be tested, weighs more than 70,000 lb and is almost 18 ft high. Three hydraulic pistons can lift it more than 12 ft above floor level, so that an entire fuselage section can be easily installed and connected for testing. The bottom half extends 15 ft below the floor and contains heating and cooling coils, circulating blowers, and service connections.

The testing equipment consists of three basic systems: ram air to simulate air scooped from atmosphere; bleed air to simulate air bled off the compressor of the jet engine; and a vacuum system to simulate atmospheric pressure at various altitudes. All three systems can be coordinated to simulate a complete takeoff-to-landing schedule, or can be operated separately if only one test phase is required.

The control system is housed in a console, 30 ft long and 8 ft high, which includes six pneumatic programmers to control temperature and pressure. Cams incorporated in the programmers determine the simulated flight sequence. Directly above the programmers are six recorders which show how closely the schedule is being followed. Other instrumentation includes

*(Turn to page 116, please)*



Raised to maximum height of 12 ft. 4 in., this 70,000-lb upper shell allows Douglas-Tulsa engineers to make floor-level installations. Lines and wires attached to RB-66C fuselage section go through grille floor and are connected in the lower half of the shell. Fischer & Porter Co. console with its double row of programmers and recorders is at left.



## *Milling and Turning*

# STEM PINIONS

### *on Automatic Machine Line*

**R**EAR axle stem pinions are produced by Pontiac in an impressive battery of six new Seneca Falls machines — the first one being a special milling and centering machine, the other five being adaptations of the familiar LoSwing Model AR automatic lathe fitted with fully automatic loading and unloading.

The milling machine is fully automatic in action, except for manual loading. It is served by an endless conveyor with 17 hydraulically clamping fixtures, and contains a built-in chip conveyor of screw type which dumps chips onto an apron conveyor at the exit end. Tooling is arranged to rough- and finish-mill to length, then center drill each end.

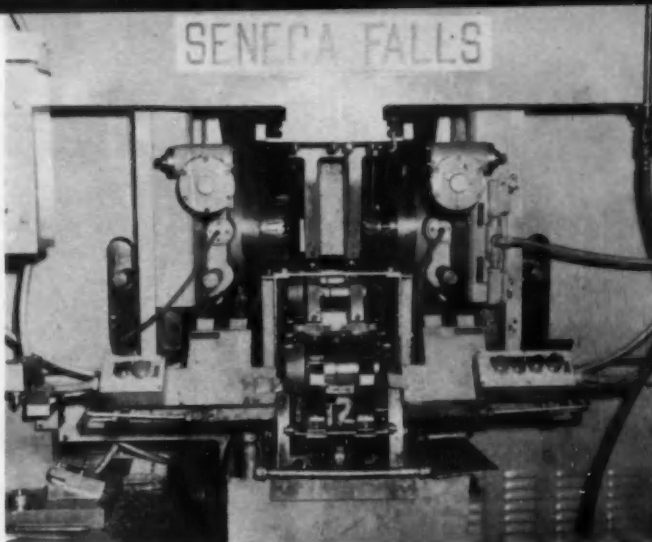
At the exit end a small elevator section picks up the part ejected from the fixture, raises it and dumps it onto a gravity conveyor leading to the first of the LoSwing lathes.

The group of five Model AR LoSwing lathes that follow consists of the same basic type of machine, except for tooling and cycling, the massive overhead structure housing the cam mechanism for actuating the loading mechanism. A major feature of the basic machine is the provision for automatic loading and unloading, employing two arms which terminate in clamping hands. As illustrated, the long arms are mounted at an angle to facilitate reaching into the work station.

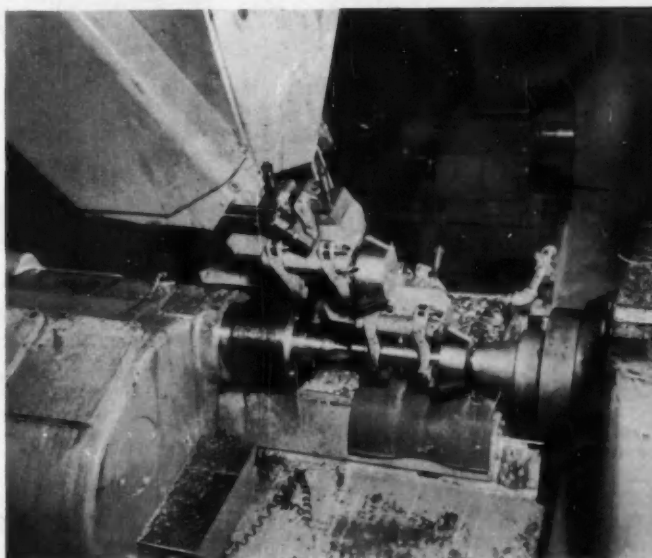
Automatic loading and unloading are done in four steps. The loading and unloading mechanism normally parks directly over the tail stock ready to extract a finished part and insert an unfinished one. Both functions are facilitated by small elevator sections—one to lift the part within reach of the hand; another to raise the finished part and deposit it on the gravity conveyor section leading to the next machine. When a cycle is

*(Turn to page 112, please)*

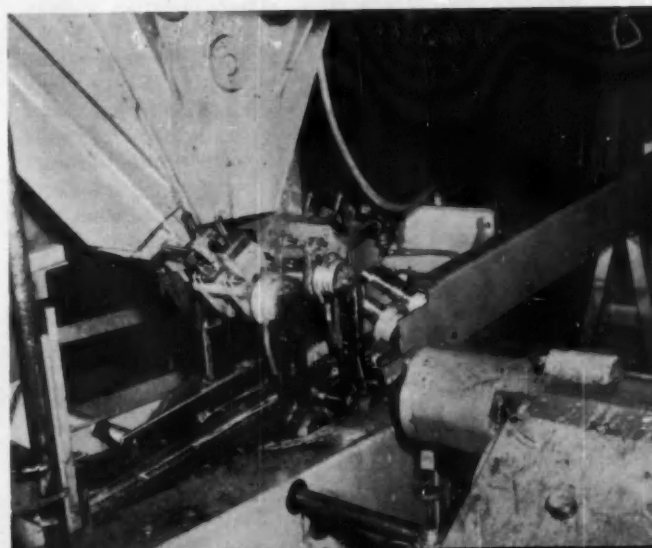
*Automatic loading arms of the Lo-Swing lathe are seen in this view at the tail stock end of the machine. One arm picks up an unfinished piece from the conveyor leading from the preceding machine; the other arm drops a finished part onto the short elevator section in the foreground for delivery to the next machine chute.*

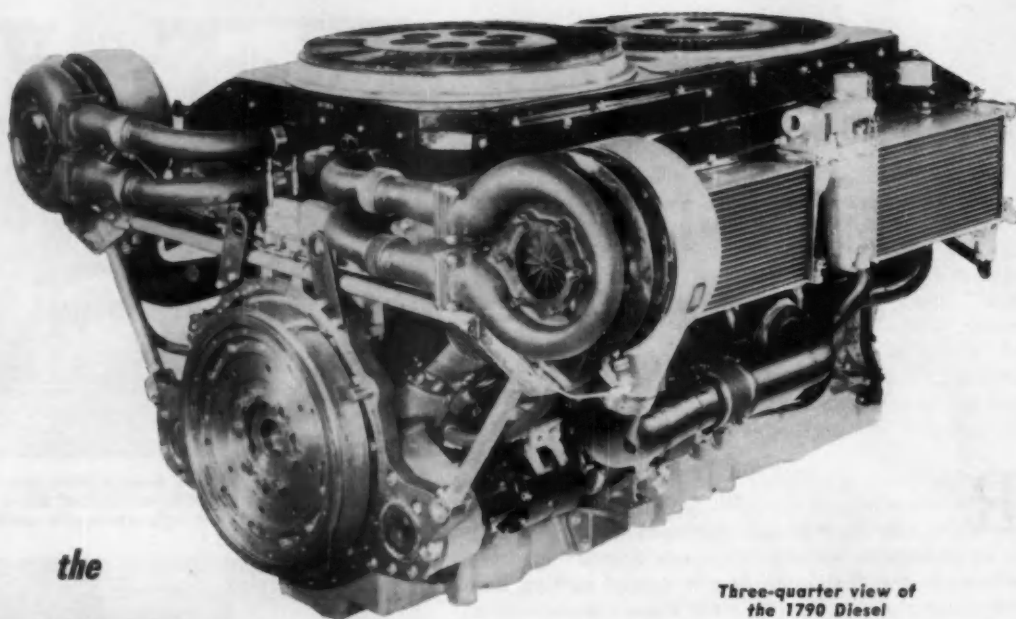


*First of the battery of six Seneca Falls machines on the stem pinion line is this special milling and centering machine, operating on a fully automatic cycle.*



*Work station of one of the Lo-Swing lathes on the stem pinion line. This illustrates the action of the two automatic loading arms: the one in the background is about to remove the finished piece from centers; the one in front will then load another part.*





*the*

Three-quarter view of  
the 1790 Diesel

# CONTINENTAL

## 750-Horsepower Aircooled Diesel Engine

By Dr. Herbert H. Haas, Chief Engineer  
and Earl R. Klinge, Assistant Chief Engineer

DIESEL SECTION, CONTINENTAL AVIATION AND ENGINEERING CORP.

**A** 750-HP aircooled Diesel engine has been successfully developed with primary purpose of reducing the fuel consumption of gasoline engine-powered combat vehicles by approximately 40 per cent. The new power plant is characterized by low fuel consumption, light weight and high compactness. The basic features of the engine are: 5.75 in. bore by 5.75 in. stroke, 1790 cu in. displacement, compression ignition, four-stroke cycle, direct injection system, 90 deg Vee, 12-cylinder, exhaust turbocharged. Rated output is 750 hp at 2400 rpm with a potential output increase up to 850 hp.

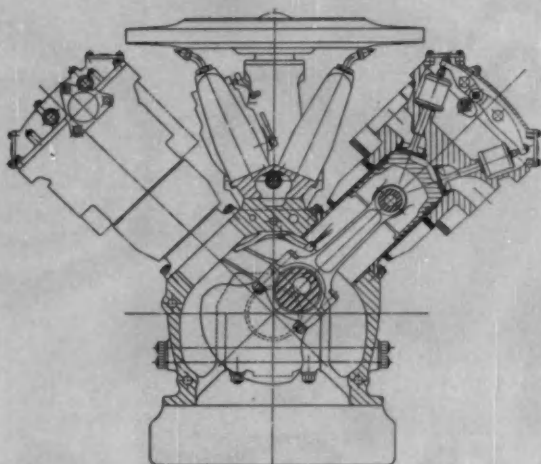
Although satisfactory gasoline engine power plants have resulted from the development work of the past, there exists a strong desire to reduce fuel consumption and increase vehicle range because of the logistic fuel problem. Various avenues of development are being pursued to achieve this objective. One of the most obvious matters to consider is whether or not the fuel economy of the Diesel engine could be utilized in solving this problem without serious penalties in other areas. The possible gain in fuel consumption is very large (Fig. 1). From this curve as well as from experience, it can be concluded that the overall fuel consumption of the combat vehicle will drop as much

as 40 per cent below that of the gasoline engines.

The turbocharged Diesel engine has two other advantages; high overload capacity and automatic compensation by the turbocharger for losses due to high altitude and high ambient temperature.

However, to achieve this goal, these points must be considered: build the Diesel engine into the same space as the gasoline engine; maintain the same net output; air cool the engine and satisfy the stringent cooling requirements; cold start down to -25 F without external aid; and make provisions to build a family of engines of different sizes using basically interchangeable major components as has been done on the gasoline series of engines in production. All these requirements could be successfully met with the development of the aircooled Continental AVDS-1790 Diesel engine.

The cooling problems discussed here are the result of specific requirements of a combat vehicle. Because a great deal of experience is now available with many thousands of aircooled engines in the Army, it is possible to conclude from this experience and from comparable liquid-cooled power plants on the market, that the aircooled engine offers these advantages: power package bulk is minimum especially when de-



Transverse section of the new aircooled Diesel engine

signed for desert conditions; power package weight is minimum; cooling power is minimum, especially in the extremely confined space of an armored vehicle; cooling trouble and cooling system maintenance are eliminated; and the problem of supplying coolants in the desert and in the arctic is eliminated. It is upon this basis that it was determined that this new engine would be aircooled.

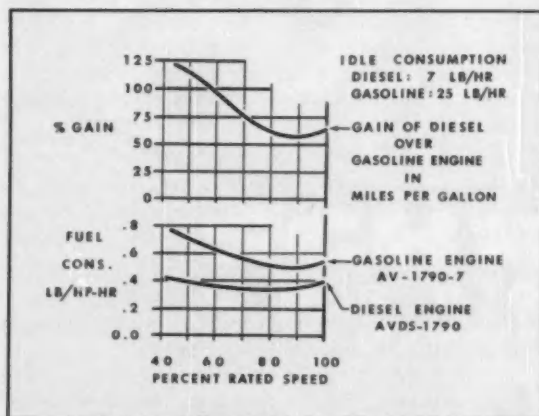
The predecessor of the AVDS-1790 aircooled Diesel engine is the AV-1790 gasoline engine which, in its various models, is currently standard for combat vehicles. Following the basic configuration of the gasoline engine, the new AVDS-1790 Diesel is again a 12-cyl, 90° V engine with overhead camshafts, the cooling fans located on the top of the engine, the

engine oil and transmission oil coolers both mounted on the engine and cooled by the engine fans (unit cooling). The engine is attached directly to the transmission.

With the features mentioned above, the similarity between the gasoline and Diesel engine ends. The high combustion pressure, the injection system, and other characteristic items of the compression ignition engine required a new design concept. Five major objectives have been set for the design and development of the new engine. (1) Provide a rigid basic engine structure which permits high unit bearing loads and reduces stress concentration and engine friction. This has been accomplished by a single piece crankcase of high rigidity and short stress path by a crankshaft of generous dimensions, and by a carefully designed bearing construction. (2) Insure adequate cooling for cylinder and piston. This has been accomplished by careful finning of the air-cooled cylinder unit, by ample oil cooling, and by adequate cylinder spacing and at the same time, minimizing the length of the accessory drive to keep the engine length within the given limits. (3) Drive the accessories in accordance to the individual requirements of each. This has been accomplished by driving all the accessories from the flywheel end and splitting the drive into two, a stiff train for camshafts and fuel injection pumps and a flexible train for the cooling fans. (4) Simplify machining, tooling, assembly and maintenance. Provide accessibility to oil and fuel filters and to the injection system (injection pumps, injection nozzles, injection timing) from the top and the front end of the engine.

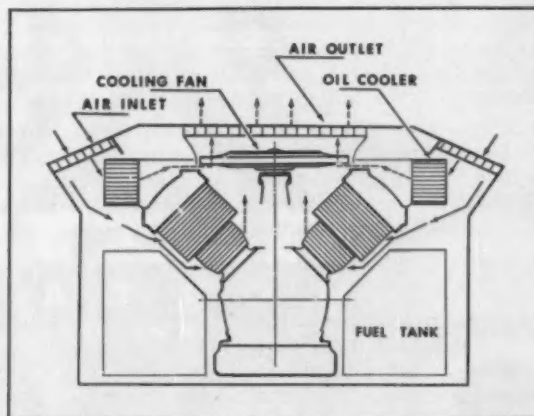
Simplification of machining, tooling, assembly and maintenance has been accomplished by dividing the engine in several major assembly units as follows: The crankcase, a comparatively simple casting incorporating the bearing construction; the accessory drive

FIG. 1



Fuel consumption of Diesel vs gasoline engine (propeller load curve)

FIG. 2



Airflow over engine. Solid lines—cool air; dotted lines—hot air

## INSTALLED ENGINE PERFORMANCE ANALYSIS

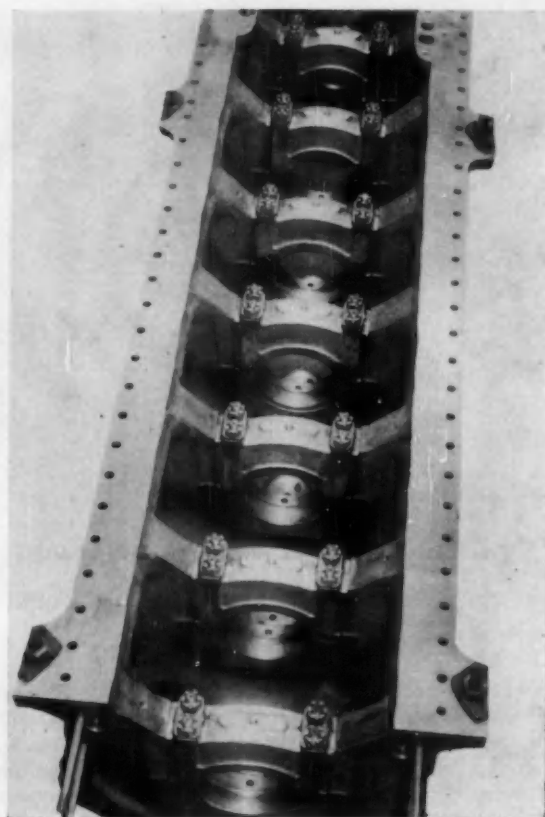
	Diesel Bare Engine (Uncorrected)	Gasoline Bare Engine (Corrected)	Diesel Net Installed	Gasoline Net Installed
Gross Horsepower.....	750	825	...	...
Power Losses				
Exhaust Muffler.....	...	...	...	25
Air Cleaner.....	...	...	...	30
Generator.....	...	...	10	10
Cooling Fan(*).....	...	...	110	135
			120	200
Net Installed Horsepower...	...	...	630	625

(\*)—Cooling fans are for unit cooled installation, cooling engine cylinders, engine oil and transmission oil on a 125 F ambient day, while installed in a vehicle hull.

assembly including the bearings, shafts and gears, as well as the automatic timing device and one fan unit; the damper and filter housing assembly incorporating the oil filters, control valves, and internal passages; the triple oil pump including the drive gears and control valves; and the oil pan including the oil reservoir for the dry sump system.

The cooling arrangement deserves some explanation (Fig. 2). The basic reason for suction cooling is to surround the engine and the fuel tanks with the incoming cold air. This permits confining the hot discharge air to a relatively small duct in its path toward discharge from the vehicle. A slight penalty on cooling fan size is endured for this arrangement as the cooling fans must handle the less dense hot air. On the other hand, it can be demonstrated that the circumferential temperature distribution around the cylinder is more uniform with suction cooling than with pressure cooling. Besides the oil coolers for the engine, the torque converter transmission coolers are mounted on the engine and cooled by the engine fans. This results in considerable space saving compared to having separate fans for each cooling function. It should be pointed out that the torque converter transmission cooling constitutes a problem in off-road operation. A large portion of the engine horsepower might have to be dissipated through the transmission oil coolers if the vehicle is operated at full throttle but nearly stalled in the mud. On the AVDS-1790, transmission oil cooling is provided for a heat rejection equivalent of one-third of the net engine output.

Another problem is the air flow restriction presented by the bullet-proof grilles for admission and discharge of the cooling air. These restrictions add considerably to the required cooling fan power. As a



Bottom view of crankcase of the 1790 Diesel engine

result, the total fan power amounts to nearly twice the fan power needed for the engine cooling alone. Two 26-in. axial fans are provided to satisfy all cooling requirements. They are mounted on top of the engine and driven at twice the engine speed.

The cooling fins are set on the cylinder head at an angle of 30 F and reach from the intake to the exhaust side of the head. Ample cooling fin area was developed by this method, although some foundry trouble occurred in casting these long, deep fins. The cooling performance of the cylinder is outstanding with a maximum head temperature of 350 F at 750-hp output at six inches of water pressure drop across the cylinder. It is felt that the success of the cylinder and the satisfactory functioning of the injection nozzle is largely due to this cooling condition.

*The foregoing is an abstract of a paper presented by the authors at the SAE Annual Meeting held in Detroit, Jan. 14-18.*

## Device Tilts Car Seat Backward Upon Impact

At least one automobile company is exploring the possibilities for a new safety device developed for car seats by Protect-O-Matic Corp. of Buffalo, N. Y. The device automatically tilts

back the front seat about 30 deg whenever the vehicle hits another object.

With the seat tilted in a semi-reclining position, the impact of the crash is absorbed on the bottom of the driver's thighs. It thus prevents

him from being thrown forward against the dashboard.

Due to the cost factor, it is unlikely that the device will be adopted by car manufacturers in the near future. The inventors estimate that it would cost about \$300 to install the unit.



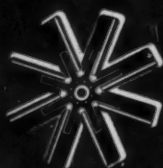


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Water Pumps

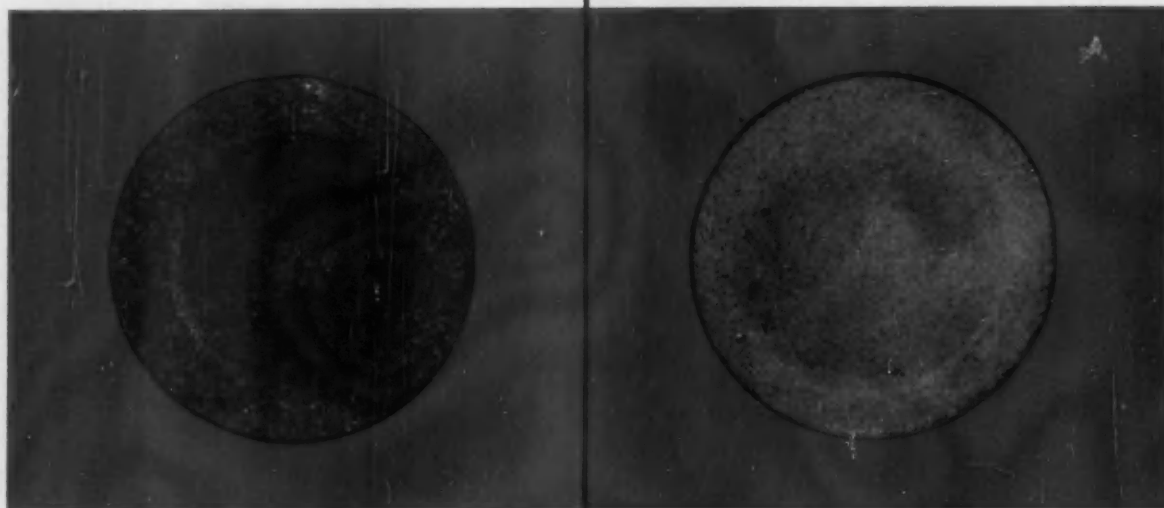


Oil Pumps

**SCHWITZER**  
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# The EATON Process of Aluminizing Exhaust Valve Heads PREVENTS PRE-IGNITION

CAUSED BY INCANDESCENT SCALE



## NOT ALUMINIZED

Note Scale which Promotes  
Pre-ignition

## ALUMINIZED

Absence of Harmful  
Scale Prevents Pre-ignition

Conventional exhaust valve steels, run at high temperatures, tend to corrode and scale, promoting damaging pre-ignition. This condition can be overcome by the use of expensive high-alloy materials. However, there is a simple and less expensive solution to the problem. By applying the Eaton aluminizing process to conventional exhaust valve steel, resistance to corrosion and scaling can be increased tremendously, thereby eliminating a condition which can be a major cause of pre-ignition.

Inlet valves conditioned by the Eaton aluminizing process also are contributing to the increased efficiency, dependability and service life of engines.

Our Valve Division engineers will be glad to discuss the application of Eaton aluminized valves to your engines. Send for illustrated literature.



## Aluminizing of Inlet Valve Seat-Face Prevents Oxidation

After aluminizing by the Eaton process, this plain carbon steel valve was placed in an air atmosphere furnace at 2000°F. for 16 hours. Gross oxidation of the base steel resulted. The aluminized seat-face and margin areas were unaffected.

# EATON

VALVE DIVISION  
MANUFACTURING COMPANY  
9771 FRENCH ROAD • DETROIT 13, MICHIGAN

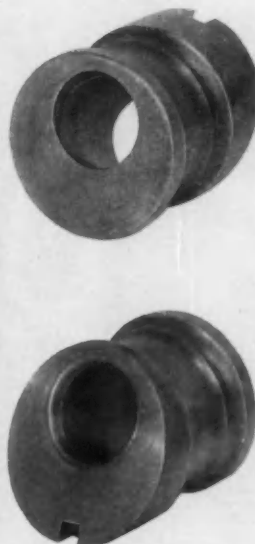
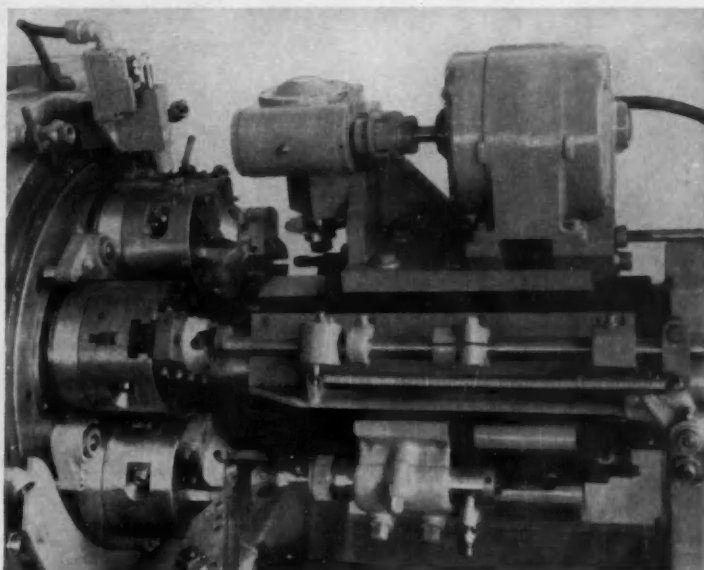


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## It pays to combine hard-to-handle operations on a versatile **BAIRD 76H CHUCKER**



industry's most versatile  
high production chucks

A glance at this photograph will show you how straightforward and "clean" the arrangement is. Yet a wide variety of operations is being performed to close tolerances on a difficult workpiece.

A unique feature is the milling of the locating slot in the direct center of the part. The milling is accomplished by stopping and accurately locating the chuck. This locating slot is used on all subsequent operations on other machines. The forming of the shape on the lead of the hole, plus the grinding relief, is done by a combination slide with a form tool.

The outer face is machined from the cross slide, which incorporates a relieving motion to eliminate draw-back marks.

**Sequence of Operations:** Drill, bore and ream .735 - .739 center hole, face end, recess back of center hole for grinding relief, form radius on open end of hole (combination slide), and mill  $.1875 \pm .001$  locating slot.

**Production:** Cycle time 44.5 seconds per piece, 80 pieces per hour gross.

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## R/M FLEXIBLE THIN-WALL *Teflon* HOSE

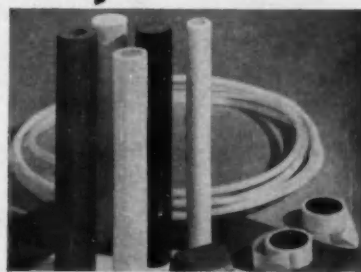
for extremes of  
corrosion, vibration and temperature

Corrosive fluids, high mechanical stresses, extreme ambient temperatures—R/M Flexible Thin-Wall "Teflon" Hose takes them all. It's your best assurance of high-integrity conveying lines.

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cally inert to hydraulic fluids and synthetic lubricants.

This major contribution to safety and performance in the automotive and aviation industries is backed by all the resources of R/M, pioneer in the development of "Teflon" products. R/M Flexible Thin-Wall "Teflon" Hose is available through leading coupling manufacturers. A list of suppliers and complete specifications will be furnished on request. \*A Du Pont trademark



Other R/M "Teflon" products for the automotive and aviation industries include rods, sheets, tubes and tape; centerless ground rods held to very close tolerances; stress-relieved molded rods and tubes; Raylon—a mechanical grade of "Teflon," having many of the properties of virgin "Teflon." For details, call or write R/M.



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# TV Views Welds Hidden from Operator

**S**TRUCTURAL spotwelding of aircraft sheet aluminum is an exacting production process which requires careful control to assure high quality. Because of the heat and pressure necessary to accomplish spot welds, the copper alloy welding tips soon pick up metal from the outer layer of pure aluminum which covers the harder alloy core. It is important in aircraft manufacture that this "pick-up" be kept to a minimum and both welding electrodes cleaned when the deposit becomes noticeable.

An experienced welder has little difficulty deciding when his welding tips need cleaning. If the part he is working on is small enough to be maneuvered by hand, he "feels" the stickiness of the tips as deposits build up. If the panel is so large it must be handled mechanically, he can see the difference in the surface appearance of his welds and learns to stop at the first sign of electrode pick-up. However, he can watch only the topside welds. Another man must sit under the welding platform with his eye trained on the spots on the underside.

In order to provide a view of the underside welds, Ryan Aeronautical Co. has located a television camera under a large welding machine. This is connected, by coaxial cable, with a 17-in. screen at the side of the welder. At a glance a single operator sees the condition of both top and bottom welds.

The only problems were the positioning of the camera to accommodate the four-way movement of the parts through the welding machine, and the proper lighting for casting the best image on the screen.

Lighting took a great deal of experimentation. It was found that fluorescent lights eliminated the glare but were not strong enough to assure a clear picture. A combination of fluorescents and incandescent floods now does the trick.



*With new TV setup, the operator easily keeps track of quality of welds on underside of large aluminum panel by checking enlarged 5½-in. spots on TV screen.*

Longitudinal and crosswise movements of the panels, as well as the constantly changing field of vision, were provided for with a movable camera, set up on an arc with simple bracketry. Powered remotely, it is operated by a flip switch and follows with ease the line of welding in any direction.

Use of two lenses on the camera has produced a side benefit, as well. A close-up provides an image full of detail; a wide angle lens shows a larger area and enables the welder to remove his work from the narrow clearance between the welding tips without bumping.

General Motors in 1955 spent \$6 billion to purchase and service goods from more than 55,000 supplier firms. The largest dollar volume went to firms located in Michigan. That is revealed in a survey which shows that the number of suppliers continues to grow as new products are developed by the company. To obtain materials for the recently introduced Chevrolet fuel injection, for example, GM added 26 new suppliers.

GM's 1955 purchases ranged from approximately \$1200 in Nevada to more than \$1.7 billion in Michigan. Next in order following Michigan are Ohio firms, which received a total of

## **GM Paid \$6 Billion In '55 To 55,000 of Its Suppliers**

\$1.4 billion in orders; Illinois, \$394.1 million; Indiana, \$200.9 million; Wisconsin, \$173.5 million.

Small companies, including a one-man firm operating in a home basement, make up the largest number of GM's suppliers. Eighty-nine per cent employ fewer than 500 persons and 64 per cent fewer than 100 persons, the survey notes. Total suppliers employ more than 12 million persons, although not all of them work directly on goods

and services for General Motors.

Many of the companies supply GM with products which would seem to have no connection with automobile manufacturing. Such items include golf gloves to protect the hands of women workers who lace and tie wiring; crushed walnut shells used in deburring cast parts; ground corn cobs, which form the base of a polishing compound; and even diapers which, because of their softness, are used in certain polishing and cleaning operations. A few other unusual items: walrus hides, baby bottle nipples, guitar picks, molasses, pipe cleaners, castor oil, cactus fibers.

# News of the MACHINERY INDUSTRIES

By Thomas Mac New

## Automated Olsen Unit Balances Ford Cranks

Crankshafts for Ford's '57 engines are being dynamically balanced at a 25 per hour rate, at 80 per cent efficiency, with automated handling and automatic processing. Tinius Olsen Testing Machine Co., Willow Grove, Pa., states that the machine can hold this rate as long as the unbalance falls in counterweights 1 and 8 and does not exceed eight ounce-inches at either end.

The automation equipment handling the cranks was built by Olsen and Wilson Automation. Wilson supplied the shuttle type loader and Olsen built the unloader and conveyor at the rear of the machine. In the loading mechanism, the crank rests on nylon blocks both on the fixed rails and on the shuttle rails. After being positioned in the loading mechanism, the crank moves twice on the shuttle before it is placed in a receiving station of the machine. This station takes the crank from the

shuttle conveyor so that the number 1 pin is in the vertical position. Then, by means of a transfer arm, the crank is placed in the balancer. It is loaded directly onto the rollers with the locating notches near the corresponding driving pins.

The pins are driven by a jogging motor until located; engagement is pneumatic. A  $\frac{1}{2}$  hp capacity, 220/440 v, 60 cycle, three phase, 1200 rpm, totally enclosed Fairbanks Morse motor is used to drive the crank during the balancing cycle.

In the balancing operation, first the left-hand cradle is locked and then the right-hand cradle. This provides a reading in each plane without overlap. A moving coil in the field of a permanent magnet receives the same motion as the cradle and generates an a-c voltage signal. Olsen's type EAA Electrodyne indicating system then translates the signal into electronic angle and amount indications. The amount of unbalance and its angular location is automatically read on two electric meters and two re-

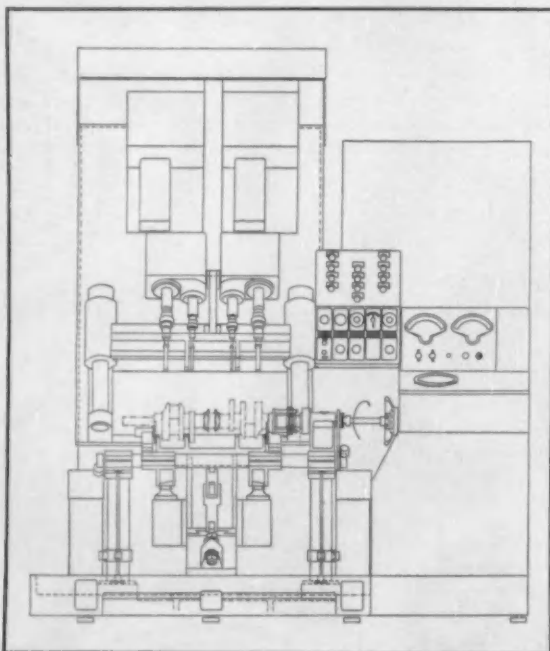
**Ford Has New Automatic Crankshaft Balancing Equipment which Loads the Workpiece, Determines Amount of Correction Necessary, and Drills Counterweights**

mote control memory devices. Readings are relayed to the drill units. The amount of unbalance is removed by drilling counterweights 1 and 8 with a  $\frac{3}{8}$  in. diam drill. One full depth hole drilled in either counterweight equals full scale deflection on the meter.

Drill units consist of two W. F. and John Barnes hydraulic heads with a total of four spindles. The main spindles take the  $\frac{3}{8}$  in. drills and the auxiliary spindles take  $\frac{1}{2}$  in. diam drills for drilling counterweights 3 and 6 if required. All of the depth servo mechanisms are mounted on the drill heads. Each drill head is driven by a three horsepower, 1800 rpm, 220/440 v, 60 cycle, three phase, totally-enclosed squirrel cage motor.

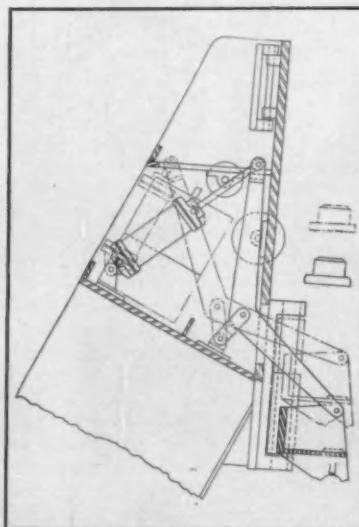
The fixture for holding the cranks includes a lift to support the units during drilling operations. Another fixture for clamping the cranks serves an additional function as a drilling jig.

After the machine's electronic units determine the amount of unbalance



**Drawing of Tinius Olsen fully automatic balancing and correcting machine with automated loading and unloading. This machine balances 25 Ford '57 engine crankshafts per hour at 80 per cent efficiency.**

**Automatic unloading clamp arrangement used on the Olsen crankshaft balancer. An air cylinder is used to actuate the toggle mechanism on the pivot arm.**



and the information for hole depth is relayed to the drill heads, an automatic positioner, operating from the angle servo mechanism, locates the crank. Should the amount of unbalance exceed one full depth hole, the automatic positioner will index for two holes.

### How Olsen Unit Works

Basically, the two-channel amplifier, known as the Electrodyn, is actuated by a signal received from the velocity-type vibration pick-up in the plane or correction. This signal is proportional to the unbalance forces exerted by the workpiece.

The first or amount channel rectifies the signal by means of an electronic voltmeter and visually indicates it on the amount meter—graduated from 0 to 100. This is an accurate indication of the amount of unbalance, which can be directly translated into terms of ounce-inches.

At the same time, the second or angle channel forms the same signal into a single pulse and indicates the phase displacement between this pulse and a reference pulse generated on the machine spindle. This value shown on an angle meter—graduated from 0

deg to 360 deg, gives the angular location of the resultant forces causing the unbalance in the selected plane of correction.

To obtain the reading in the second channel, the signal from the vibration pick-up passes through a pulse forming circuit which takes the sine wave from the pick-up and forms it into a square wave. When a sharp leading edge is formed on the square wave, it is reduced to a single pulse. This is one of the two pulses fed into an electronic phasemeter. The second pulse comes from the reference pulse generator located on the spindle of the machine. The electronic phasemeter indicates the phase difference between these two pulses on the angle meter. An electronic relay circuit is used in the phasemeter to determine the time interval between the pulses.

### Developments in Honing

At a national press conference held last month Micromatic Hone Corp., Detroit, Mich., presented a preview of notable developments in microhoning techniques of general interest to the industry. Much interest was shown in

completely automatic equipment for honing ball studs and ball ends to extremely fine surface finishes and with excellent geometry.

Fully automatic equipment—including loading and unloading—for the finish honing of inner and outer races for ball bearing assemblies was described. Geometry and surface finish of honed elements for commercial bearings is claimed to be superior to the precision bearing classification in general practice.

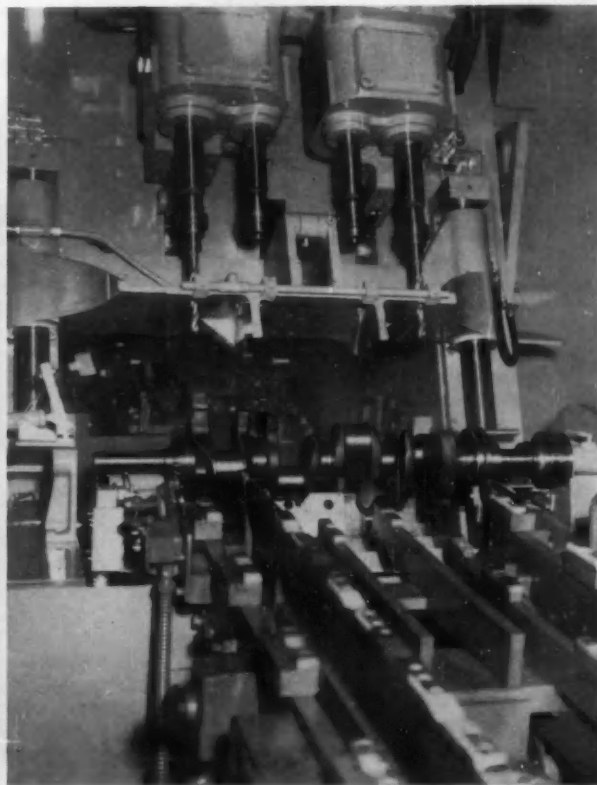
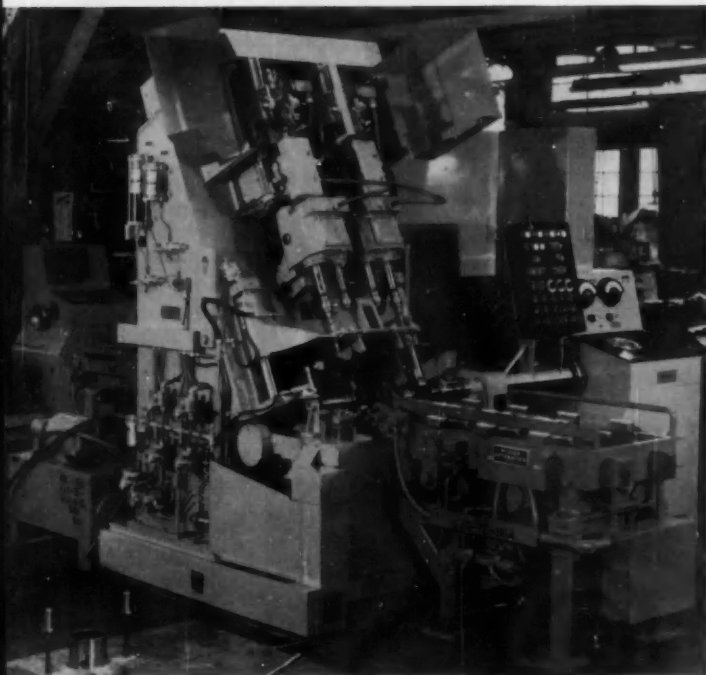
In the opinion of Micromatic engineers the use of Teflon plastic molding material for the ball sockets of ball joints marks a major step forward since it reduces the number of machined parts, conforms to the contour of a honed ball end, and eliminates the need for seals.

The company has made considerable progress in the development of automatic sizing devices. One of the latest developments is an eight-spindle, inline vertical honing machine for cylinder bores. It takes two blocks at a time and finishes each bank at the same station by means of a special indexing fixture. This machine is fitted with Microsize air gaging which makes it possible to hone to exact

(Turn to page 122, please)

Front view of the balancing machine with crankshaft in position.

The depth servo mechanisms are located in drill head housings. Depth is set by a cam actuated by the amount meter in the Electrodyn unit.

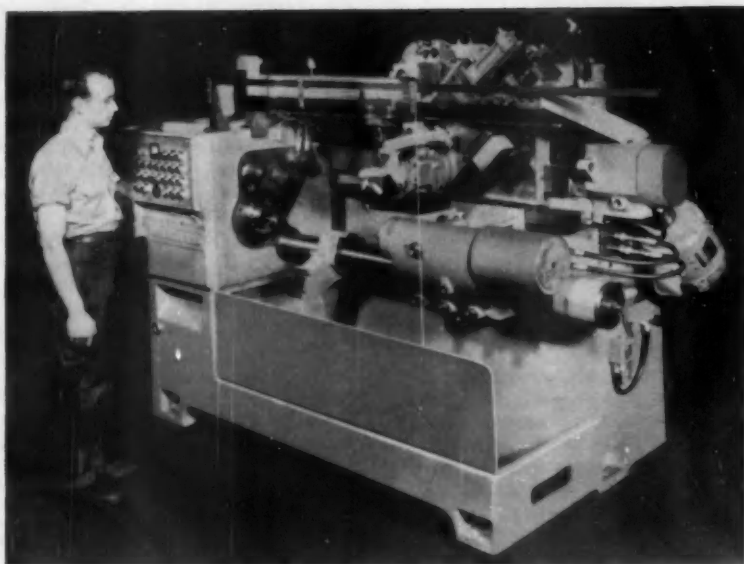


# NEW

# PRODUCTION and PLANT

# EQUIPMENT

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89



Sundstrand Model 14T multi-cycle tracer lathe

## Automatic Multi-Cycle Tracer Lathe

SEVERAL operations in the machining of irregular shapes can be handled by a hydraulic tracer lathe recently announced. Two roughing cuts, a semi-finish and finish cut may be obtained in one automatic cycle. Only one template is required for the multi-cycle cuts. An indexing tool turret permits the use of two cutting tools, one for roughing and one for finishing. Shoulder facing tools can be provided if desired for squaring and other operations.

The stylus, template and workpiece are in full view of the normal operator's position. Front loading lends itself to easy handling, and is suited for automatic handling mechanism if desired. With the tracer controls and stylus on the top carriage, chips and dirt will not accumulate on the template and impair machining accuracy. Ample chip room is provided, with provision for automatic chip removal if desired.

The transmission type head is available in a 2, 4, or 8 speed type. Automatic speed changes are provided for all cuts of a cycle with each type of head. The proper spindle speed for

the best surface finish and feed is said to be automatically maintained.

A direct reading scale is provided for positioning of the tailstock. All controls and adjustments, including that for the template holder, for setup and for tool wear, are so located that template changes or machine adjustments may be made with a minimum of effort. Sundstrand Machine Tool Co.

Circle 30 on postcard for more data

## Titanium Descaling

DEVELOPMENT of a chemical process that is said to efficiently descale titanium and its alloys without adversely affecting the physical and chemical properties of the metal, has been announced.

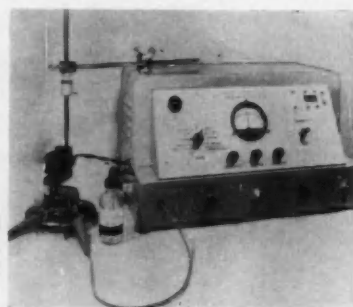
The process uses two immersion steps (one for scale conditioning and one for scale removing) and two rinsing steps, following the heat forming or heat treating operation. It requires relatively-low temperatures of 270 to 280 F; and is stated to result in low metal loss (0.0001 to 0.0003 in. per

side), and to be suitably inhibited to avoid hydrogen pickup and resultant hydrogen embrittlement ( $\pm 4$  ppm or 0.0004 per cent hydrogen per cycle). It is also said the process gives complete chemical cleanliness without warping thin gage material, causing salt entrapment in faying edges, creating fire hazards, or adversely altering the physical characteristics or surface smoothness of heat treatable alloys. Turco Products, Inc.

Circle 31 on postcard for more data

## Thickness Tester

IN determining the thickness of plating and other metallic coatings deposited over various metals and non-metallic base materials, the Model 955 electronic tester is said to give direct readings with an accuracy of 90 to 95 per cent. A multiple position switch is provided for the various types of plating to be tested. The thickness of decorative and heavy chromium, silver, tin, cadmium, zinc, copper, brass, nickel, lead, lead-tin, and tin-zinc can reportedly be determined on steel, copper, brass, aluminum and other metals, and on non-



Kocour Model 955 electronic tester for thickness measurement of plating

metallic materials such as ceramics and plastics.

Features of the tester include a new calibration adjustment, and a new constant pressure device which automatically maintains a uniform pressure between the test cell and specimen. Kocour Co.

Circle 32 on postcard for more data



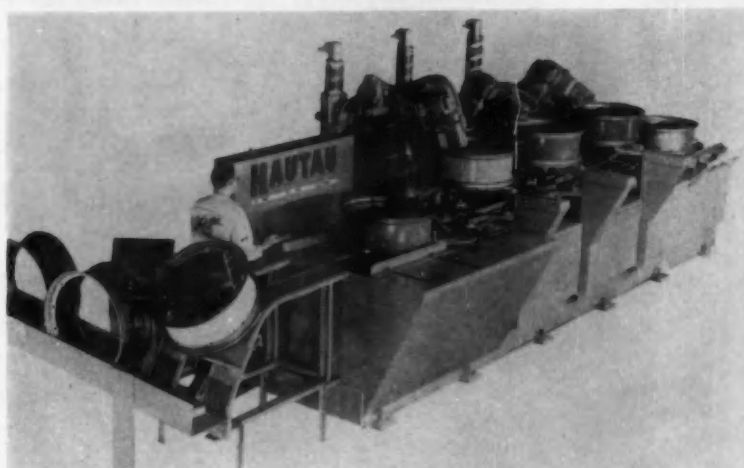
## Wheel Rims Processed On Five-Station Machine

**T**HREE 50-ton hydraulic presses have been integrated with an in-line transfer mechanism to provide a compact high production five-station machine that automatically performs the operations of embossing, piercing and chamfering on large wheel rims. Production rate is said to be about 400 rims per hour.

The presses are flexible, being capable of adjustment in three planes, as well as having a rotary adjustment; thus simplifying the dies for the different rims. The heavy "C" frame construction is said to take the action and reaction forces of dies, eliminating deflection of the rest of the machine. The frame is rapidly advanced on ball ways to the pressing position by an air cylinder. The press ram, in turn, is powered by a hydraulic booster cylinder and has a pressing stroke of two inches.

The transfer mechanism is hydraulically powered up and down on ball ways a distance of 10 in. by a parallel rack arrangement. A three-station traveling carriage transfers the rims when the lift mechanism is in the down position. Mounted to the lift mechanism at each station are adjustable clamps for clamping the various diameter rims. The traveling carriage reciprocates back and forth on large vee-type rollers, progressively transferring the rims from one station to the next.

In the processing cycle the wheel



*Hautau five-station machine automatically processes large wheel rims at the rate of about 400 per hour*

rims roll down an incline where a mechanical loader elevates them to the loading station. The traveling carriage shuttles the rims in process to their next stations. The power clamps are actuated, clamping the wheel rims in all stations. The rims are then elevated to the pressing position. The presses perform the embossing operation at station 2, piercing the valve stem hole at station 3 and chamfering at station 4; station 1 and 5 being the load and unload stations. After the pressing operation is complete, the

elevating mechanism is lowered and the rims unclamped. The rims are then transferred to the next stations.

Each pressing station is powered by a six inch hydraulic booster cylinder which in turn is operated by a separate pump unit. Each pump supplies 30 gpm and is powered by a 20-hp, 1800-rpm electric motor. All three motor pump units are mounted on a 200-gal reservoir. The machine size is about 15 by 35 by 7 ft high. *Hautau Engineering Co.*

Circle 33 on postcard for more data

## Automatic Plating and Processing Machine

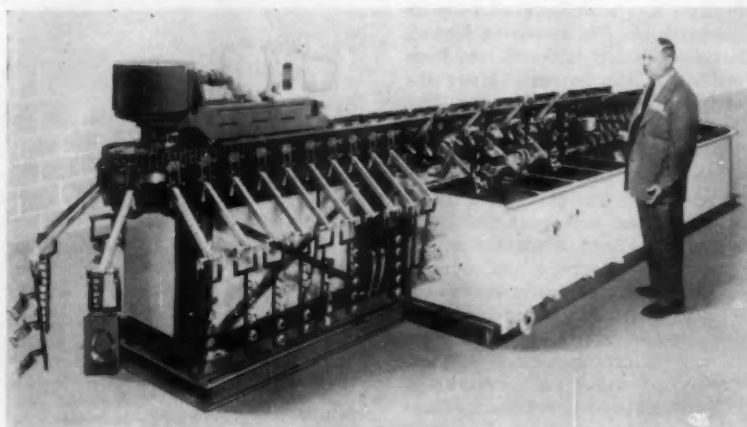
**F**EATURING versatility and compactness, an automatic plating and processing machine just announced

was designed to meet needs for a production plating unit for small and medium-sized parts. It is also said to

satisfactorily fill requirements for a small automatic plating machine with a big capacity for finishing larger parts that do not require extremely high production. Called "Little Steve," it reportedly is suitable for alodine processing of aluminum, silver plating, dichromate processing, tin immersion, and copper, zinc, nickel, brass and chrome plating. The machine is 7 ft wide and 10 or more feet long overall.

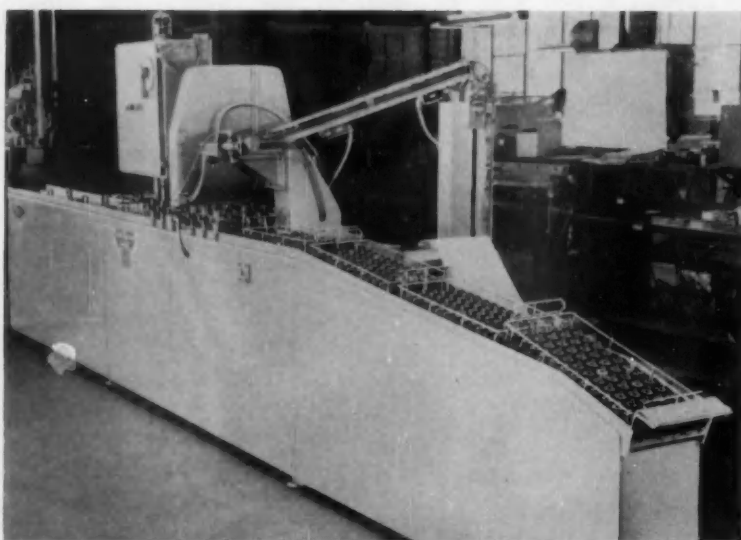
There are three handling methods for processing smaller parts on the unit: (1) The carrier arm acts as a holder for small individual racks; (2) the carrier arm acts as a rack and small parts are attached directly to it; or (3) the carrier arm acts as a rack and the arms are racked rapidly on and off the carrier arm bracket of the machine. *Frederic B. Stevens, Inc.*

Circle 34 on postcard for more data



*Stevens "Little Steve" automatic plating and processing machine*

## NEW PRODUCTION and PLANT EQUIPMENT



High-speed automatic basketing of parts, recently developed by the Gear-O-Mation Div., Michigan Tool Co., is designed for integration into automated or semi-automated production lines. With this new equipment 3000 parts per hour can be basketed, with interlocking circuits of limit switches automatically controlling the operation.

### Method for Automatic Basketing of Parts

A HIGH-SPEED method for automatic "basketing" of parts during processing is said to boost the efficiency of automated production lines. As shown here, the principle is used to basket small centerbored pinions, up to 1½-in. pitch diameter, at a loading rate of 3000 pieces per hour, as they come from a Michigan electro-audio tester. Although each basketing unit is custom-tailored to a specific job, it is assembled from standard components.

In operation, parts are fed to a dropping mechanism through an enclosed track using chain lifts and gravity flow. Rate of feed is variable through standard interlocked limit switches. As they leave the incoming track, the rolling parts are guided and tipped through a curved channeled fixture and held at the bottom end. Release into baskets is from this point and is actuated by automatic indexing of the basket. The parts are dropped onto upright basket prongs a row at a time.

Empty baskets enter the unit on a chain conveyor and are horizontally positioned by spring clips. Before passing beneath the "drop," vertical positioning of the basket is effected by locked roller guides. Indexing of the basket is accomplished by limit switches triggered by the chain drive. The baskets stop at the loading station. As each row of prongs in the basket is loaded, the next row of

prongs is automatically indexed into place. Double or triple dwell of the indexing can be provided so that two or three gears may be stacked on each prong of the basket if desired. The indexing arrangement is self-controlling, as end of the run or a malfunction at the loader will stop the equipment. The loaded baskets are shunted over gravity rollers and conveyor chains to the next operation. Gear-O-Mation Div., Michigan Tool Co.

Circle 35 on postcard for more data

### Revolving Fork Truck

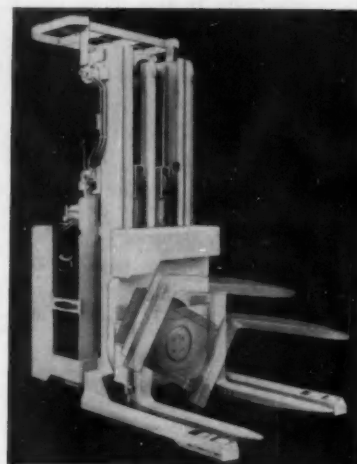
AN electric truck with revolving forks has been designed to serve a dual purpose. The revolving feature allows small parts to be dumped from steel boxes into hoppers. When the forks are in a normal position the truck is used to stack boxes in storage areas.

A hydraulic motor powers the revolving mechanism through a chain driven sprocket and gear reduction. The forks move in a continuous 360 deg arc in both clockwise and counter-clockwise directions. Movement is controlled by a hand-operated hydraulic valve. Oil pressure to operate the revolving fork arrangement is developed by a single motor and pump, which also furnishes power for the hydraulic lifting arrangement.

It is said the complete assembly is

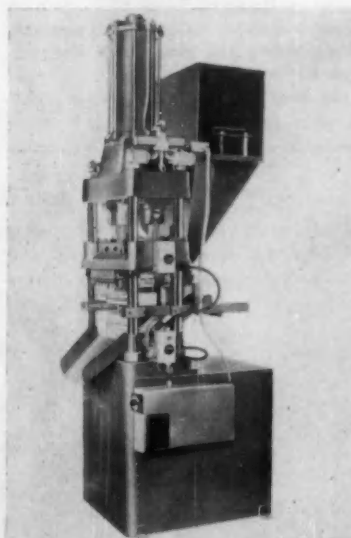
very compact and does not detract from the efficiency of the truck, which is especially designed to operate in narrow aisles. The device can be installed on any 4000-lb capacity straddle truck made by the company. The Raymond Corp.

Circle 36 on postcard for more data



Raymond revolving-fork truck

### Molding Press



The Automold A50-8 automatic compression molding press illustrated is said to offer increased production rates through new design. It produces 50 tons with a nominal 100 psi air line pressure; and is reported to be rugged enough to permit operation on 120 psi, producing 60 tons, if desired. A three-roller toggle system for increased stability and added performance is also stated to be a new feature. (Automatic Molding Machine Co.)

Circle 37 on postcard for more data

## Fully-Automatic Pushbutton Surface Grinder

**T**HE Reid-O-Matic 824 power-operated surface grinder, recently introduced, handles workpieces up to 8 by 24-in. size with pushbutton controls. Dial controlled speed of the table is infinitely variable from 5 to 75 fpm. Cross-feed drive is dial controlled for infinitely fine adjustments from 0.001 to 0.125 in., and a selector switch controls cross-feed at either or both ends of the table travel. All pushbutton controls for operation are contained in a single station located at finger-tip level on the right side of the machine.

Table traverse is through an electric clutch transmission in which all parts run in an oil bath. A variable speed d-c motor drives two clutches; at the end of each stroke a reversing switch de-energizes one clutch and energizes the other, reversing the direction. The table is connected to the transmission by a timing belt drive. Featured is low-pressure automatic lubrication for constant oiling of all way surfaces.

The column casting with ribbed construction is said to provide rigidity; and adjustable gib on the dovetail headways to give an accurate sliding fit for the grinding head. A

*Reid - O - Matic 824 pushbutton controlled surface grinder has a worktable 66 by 10 1/4 in. overall, with an 8 by 24 in. working surface and 15 in. clearance under the wheel. The two horsepower cartridge type motorized spindle mounts a 12-in. wheel for 1800 rpm operation. Features of the machine include cross feed selector buttons, automatic or hand table traverse, and full power control of all adjustments.*



two-horsepower cartridge type motorized spindle with a four-inch diameter barrel is mounted in the head. The spindle mounts a 12-in. wheel for 1800 rpm operation.

The elevating handwheel has a slip ring for zero resetting and a vernier for adjustment in 0.001-in. increments. Reid Brothers Co., Inc.

Circle 36 on postcard for more data

## Staking Machine



*The machine pictured was developed for feeding and staking clips to automobile window trim at high rates. It includes a vibratory parts feeder in which the clips are oriented and fed to the staking device. An electro punch unit with a device adaptation, deposits and stakes the clips in the trim. (Automatic Methods Inc.)*

Circle 39 on postcard for more data

## Right-Angle Air Nutsetters

**A**VAILABLE in capacities up to 1/2-in. bolt size, a completely new line of right-angle nutsetters is said to be light-weight, more simple in design and to have added power. The company is offering the rotary air nutsetters with direct drive in six models and two types: No. 4RDC heavy-duty type in speeds of 350, 600, 1100 and 1300 rpm, and No. 4RDXC type in speeds of 800 and 1300 rpm. The latter two models are equipped with smaller proportioned right-angle attachments for use in close quarters.

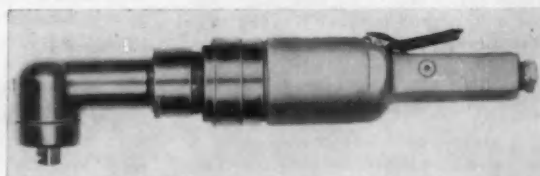
The tools have unit type attachments, interchangeable from one machine to another. All bearings in the attachments are anti-friction. The cylinder housing is an aluminum alloy casting in one piece with a straight throttle handle. The motor is a five-blade type with an alloy steel one-

piece rotor and shaft. It is said that friction is cut to a minimum in the new models because the rotor literally runs in space on its bearings.

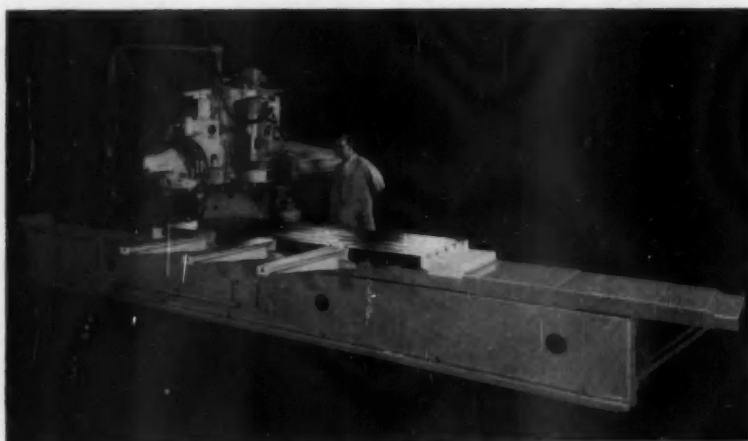
A distinctive feature is stated to be the lengthwise slotting of the gear case at 90 deg intervals. The angle type nut setting attachments are keyed to these slots, permitting positive locking of the attachment. Idler or planet gears are made of high grade, heat-treated alloy steels for added strength and durability. The line also includes an oil reservoir in the throttle handle for automatic lubrication of rotor blades and cylinder bushings. Gears and rotor, gear case and attachment bearings are grease lubricated and require attention only at maintenance checks. Thor Power Tool Co.

Circle 40 on postcard for more data

*Thor No. 4 series right-angle air nutsetter for capacities up to 1/2-in. bolt size*



## NEW PRODUCTION and PLANT EQUIPMENT



Rockford hydraulic planer-type air-frame mill

### Hydraulic Air-Frame Mill for Aluminum

**S**PECIFICALLY designed for high-precision machining of variable and complex shapes such as air-frame parts, a new hydraulic planer-type mill is available in heights of 30, 36 and 42-in., widths of 30 or 36-in., and with stroke lengths of 6, 8 or 10 ft. Both bed and table ways have been designed for tracer-milling control. These ways are square with suitable hold-down for vertical adjustment and a narrow guide on the column side. The full rated stroke of the machine is available for all lengths. As the maximum stylus-tool adjustment is also the rated width of the machine, a sub-plate or extension bars are required to carry the master to machine a workpiece as wide as the table.

The hydraulic power unit is a 7-1/2 hp unit employing tandem mounted pumps. One is used for cross and longitudinal movement and one used for vertical movement. The power unit also includes a heat exchanger with automatic temperature control to maintain constant oil viscosity for accurate duplication. A completely separate and independent one-horsepower pumping unit is used to counterbalance the duplicating head and is also used for table lubrication.

The milling head is extra equipment. A 15/30-hp, 1800/3600 rpm high-speed milling head is shown in the illustration, but several variations are available. This head is equipped with a No. 50 National milling machine taper and draw bar. The spindle is arranged with a Warner electric brake, and the head is water-cooled and protected with pressure and thermal switches to insure proper cooling.

A three-dimensional tracer valve is mounted on adjustable slides for lon-

gitudinal, cross and vertical adjustments for varying the relationship between cutter and stylus. An additional tracer valve, arranged with a four-position turret stop, is provided for variable depth control for 360 deg contour operations. A selector button, located on the control pendant, selects which valve is to be used. Electrical and hydraulic interlocks are provided between the two valves to avoid the possibility of damage to the machine, valves, work or operator. In the case of power failure or accidental motor shut-off, an automatic lift valve operates. *Rockford Machine Tool Co.*

Circle 41 on postcard for more data

### Dip Coatings

**F**OUR low-cost Unichrome dip compounds have been introduced to be used as finish coatings in zinc and cadmium plating operations. It is said they have been field tested and found suitable for hand operated still tanks, barrels, and fully automatic machines.

On zinc plated parts, dry dip compound 1085 gives a bright, clear coating to the zinc plate and is considered ideal for products plated in bulk and products subject to outdoor exposure. Used in low concentration, 1085 is said to improve appearance and shelf life of plating at low cost. It is a leachless, chromate type dip.

Having the same properties as the dry 1085 dip compound, but furnished as a liquid concentrate, 1090 is used in solutions of 50 volumes to one and is stated to give very low cost finishing.

Especially adapted to finishing cadmium plated parts but also employed with zinc plating, dry dip compound 1084 provides an economical, corro-

sion-resistant finish. Used in low concentration it is suitable for finishing thin plated bulk work in either hand operated or automatic lines.

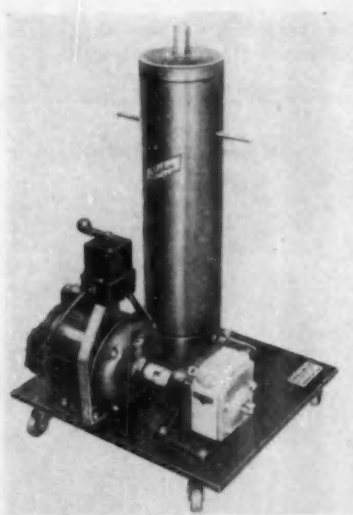
Unichrome dip compound 99 is a liquid version of 1084. *Metal & Thermit Corp.*

Circle 42 on postcard for more data

### Plating Filter Pump

**A**PPlicable for filtering chromium plating solutions, as well as all common acid and alkaline electroplating and industrial solutions, the Model VPHI-20 filter pump is rated at 200 to 300 gph. Features include all-plastic corrosion-resistant construction, self-priming pump, filtration of particles down to one micron, and an optional reversal switch for back-washing filter chamber and cartridge.

The filter chamber is of polyvinyl chloride with vinyl coated center rod and vinyl and Teflon gaskets. It contains two No. 10 dynel filter tubes. A steel outer casing is used to give added support. The pump has a poly-



Sethco Model VPHI-20 chromium plating filter pump with reversal switch

ethylene body with Hypalon impeller; and is self-priming and self-lubricating. Motor is 1/4-hp, 110-v, 60-cycle, single phase, totally enclosed, ball bearing, capacitor type. Twenty feet of vinyl hose and a pvc strainer for inlet are provided. The equipment is mounted on a phenolic lined surfaced panel 16 by 18 by 1/2-in. thick, equipped with ball bearing rubber tire casters. *Sethco Mfg. Co.*

Circle 43 on postcard for more data



## Plug-In Busway

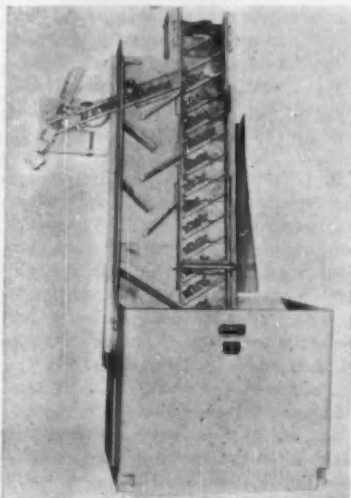
A NEW plug-in type busway with low-voltage-drop characteristics has been announced. Known as the Type LVDP, it is designed for use in industrial plants where high-capacity and low-voltage-drop characteristics are necessary in conductors feeding welders and similar equipment and in multi-story buildings where frequent power tap-offs are required.

Low power loss and low-voltage-drop characteristics are obtained by interlacing closely-spaced bus bars in recurring sequence with no adjacent bus bars having the same polarity. The busway is for three-pole applications and is rated from 600 to 4000 amp, 600 v or less. It comes in standard 10-ft straight lengths, each with 10 plug outlets, five on each side, with either aluminum or copper bus bars.

According to company engineers, installation costs for the Type LVDP busway are lower than for most conventional low-voltage-drop feeder systems utilizing cable tap boxes for tap-offs. It is interchangeable with the Type LVD feeder busway and can be installed in new or existing LVD systems if plug-in tap-offs are required. *General Electric Co.*

Circle 44 on postcard for more data

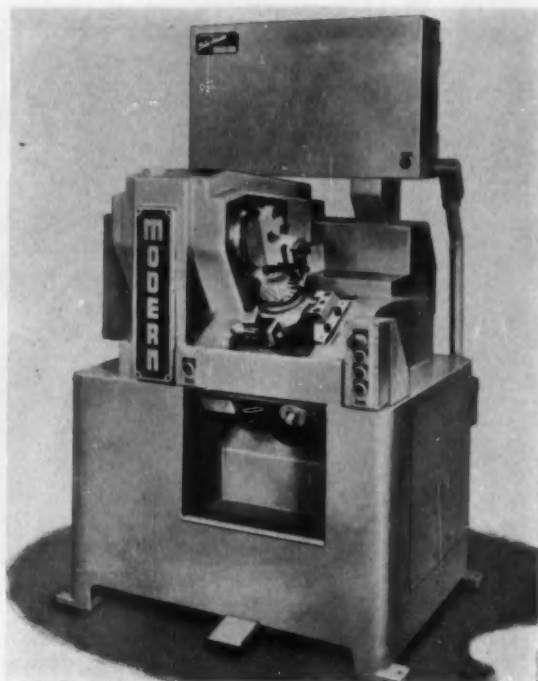
## Unit Feeds Grinder



This unit, a modification of the Model 2500, was designed to automatically feed universal joint spiders to a centerless grinder where four diameters are ground in one operation. The parts are placed in the nine cubic foot hopper, from which they are taken by the elevating conveyor to the delivery chute and then, oriented, delivered to the grinder. (*Feedall, Inc.*)

Circle 45 on postcard for more data

Fully controlled deburring and chamfering of medium to large hypoid pinions with short or long shafts is said to be a high-speed operation with this versatile single-station Burr-Master. Designated Model BMHP-15, the machine has a completely automatic machining cycle, and will handle pinions of 8 to 15 teeth with an OD range of 3 1/4 to 8 in. and shaft lengths up to 15 in., at production rates up to 280 gears per hour. Cutting is dry; coolant is unnecessary.



## Machine Deburs and Chamfers Hypoid Pinions

ANNOUNCEMENT has been made of a versatile single-station Burr-Master for deburring and chamfering medium to large hypoid pinions with short or long shafts. The machine, Model BMHP-15, handles pinions of 8 to 15 teeth, with an OD range of 3 1/4 to 8 in. and with shaft lengths up to 15 in., at production rates up to 280 gears per hour. Using a push-button controlled, completely automatic machining cycle, operation is said to be so simplified that one operator can easily handle two machines. It comes to a full stop with the cutting tools retracted, when the operation is completed. The machine does the following: (1) Deburs and chamfers acute angle profile and part of root at toe end of each tooth; (2) does the same at the heel end of each tooth; and (3) when required, produces a peripheral chamfer on large end, removing sharp edges.

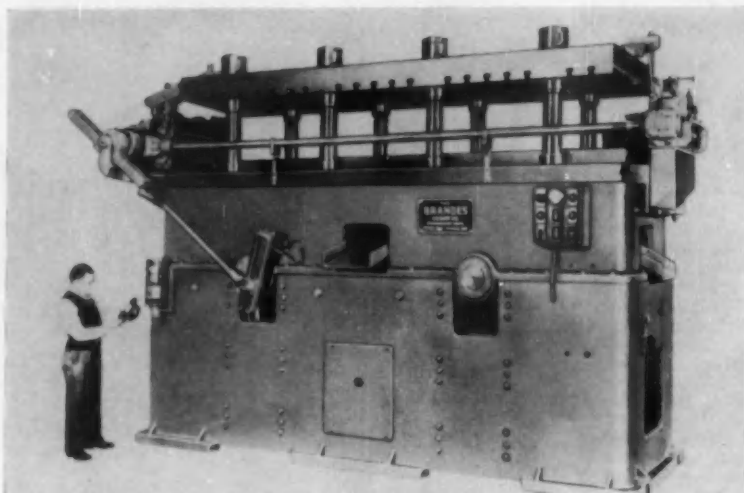
Pinions are inserted, shaft down, in the work station and the radial locator lever is actuated by the operator to make certain the part is positioned properly. This automatically energizes the clamping circuit so that the part can be clamped by pressing a pushbutton. The machining cycle is started by means of two push-buttons, located on opposite sides of the machine for maximum operator safety. A light on the front of the machine is lit while the machine goes

through its cycle. The part is ejected by pressing a foot pedal. This also has a safety interlock to prevent accidental ejection while the machine is running. Cutting is dry; coolant is unnecessary. Depth of cut desired is readily adjustable. Automatic indexing of the pinion from tooth to tooth takes place during the return stroke of the tools, permitting three cutting strokes per second.

Keynoting the versatility of the machine is stated to be its quick and easy changeover from one size pinion to another. All that is required is to reset the radial location fixture and the carriage position, insert preset tool holders, and change one timing gear through a rear access door. Under certain conditions, the machines can reportedly be tooled for four different diameter pinions in a 10 minute changeover. With all fixtures pre-located, no further adjustments are said to be necessary after tooling is in place.

Specially developed HSS form tools of the dovetail type are used. When regrind is necessary, tools are reset without gaging by bringing them against a stop bearing on the tool face. Relief grinding is unnecessary. The machine is provided with a built-in chip disposal chute, and automatic chip disposal is available if required. *Modern Industrial Engineering Co.*

Circle 46 on postcard for more data



Brandes 450-ton double crank automatic press designed for high-speed production of dual headlight bowls

### Automatic Press for Headlight Bowl Production

**B**UILT for use in the production of dual headlight bowls, a new standard 450-ton double crank automatic press will take a die 170 in. long and 36 in. wide. Design features are said to assure even pressure at all die stations through the use of eight guided draw rods and eight vee-way guides built into the base of the machine. Tipping under load is held to

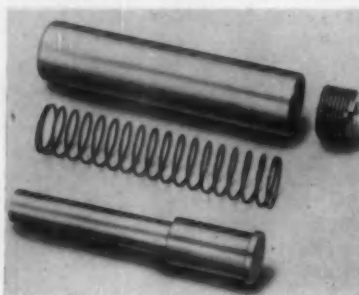
the minimum with top platen held parallel with bed to 0.002-in.

The standard double crank progressive die presses are available in sizes from 100 to 4000 tons and with strokes up to 24 in. Space is provided for die cushions on the top platen, as well as for die cushions inside the press. *Brandes Press Co.*

Circle 47 on postcard for more data

### Single-Acting Cylinder

**N**ow being marketed is a single-acting cylinder having only two moving parts which is said to be adaptable to a wide variety of appli-



Sahlin single-acting cylinder

cations such as lifting, ejecting, clamping, back-gaging, and similar uses. It is being applied as a "kicker" in pressroom installations and as a disappearing back gage pin facilitating loading and unloading of stampings. The unit measures 3½-in. plus stroke in length and 1¼-in. diam, and

can be actuated by a 30-psi air line. The strokes commonly used are the 2½, 4½ and 6-in.

The "kicker" is made with a thin-walled piston rod to avoid damage to die sections in the event of air line failure. Total collapsed thickness of the piston rod is stated to be comparable to the gage of metal being formed or fabricated in the dies. *Sahlin Engineering Co., Inc.*

Circle 48 on postcard for more data

### Power Systems

**I**NTRODUCTION has been made of new Uni-bus power distribution systems combining flexibility, low-impedance characteristics, and plug-in construction. Special plug-in units and interlocked plug-in opening covers provide maximum safety during installation and relocation. Bus bars are covered until the plug-in devices are fastened to the busway over the plug-in opening.

Interlocked, silver-plated contacts operate so that it is impossible to interrupt the current with the con-

tacts. The switch or breaker must open the circuit before the contacts can be removed from the bus bar and the cover of the unit can be opened. Although no live parts are exposed when the cover is open, the contacts in the open position are visible for identification.

Corprene separators and liners provide a resilient mounting which clamps the bars sufficiently to permit vertical mounting. At each joint, phase collection provides load equalization and high short-circuit strength with approved ratings up to 50,000 amp RMS. Flexible connectors consist of two attachment boxes joined with flexible conduit and cable. The one unit reduces the number of special fittings usually required and eliminates the need for detailed field measurements.

Uni-bus three-pole housings are the same for all ratings; they measure 3½ by 7¼-in. The busways are available in copper or aluminum with single run ratings of 225, 400, and 600 amp in 2-, 3-, and 4-pole housings. An 800-amp rating is available in copper only. *Westinghouse Electric Corp.*

Circle 49 on postcard for more data

### Turret Punch Press

**W**ORK is mechanically located and punched without layout with a turret punch press recently announced for handling frame side rails, fish plates, and other frame members used in the manufacture of trucks and similar products. Designated type R-152, this 150-ton capacity unit punches holes in channeled frame members up to ¾-in. thick.

Both left and right hand members can reportedly be handled with equal ease regardless of length. The operator uses a handwheel for each motion to position the work for punching. Work positioning information is read from a work chart. This shows the required tool or turret station number and the dimension from the two edges of the work for each hole. Dimensions corresponding to the position of the work are read from two dials set in the operator's control station.

Twenty punches and dies up to three-inch diam or three-inch square are carried in the turrets ready for use. Any tool is brought into punching position in 1½ to 5 sec with the automatic station selector on the operator's console. *Wiedemann Machine Co.*

Circle 50 on postcard for more data

## Cleaning Solvents

**N**ONFLAMMABLE solvents that will remove oil, grease and dirt without harming delicate metal parts or electrical insulation, yet are safe enough to use in ordinary work areas with conventional ventilating equipment, are now available according to an announcement. Adaptable to vapor degreasing or cleaning by liquid immersion, the solvents will be marketed under the "Freon" trademark.

Their big advantage, the company says, rests in their safety, both from a personnel exposure and material standpoint. Because they are non-flammable and nonexplosive, they can be used in open shop areas without danger of fire. In addition, from an inhalation toxicity standpoint, they are rated as the safest of the commonly used nonflammable solvents when used in properly designed equipment which minimizes vapor losses.

Most important use proved to date, the company said, is in cleaning of electrical motors, both new and re-conditioned. Tests indicate that the "Freon" solvents will not soften, craze or dissolve any of the commonly used wiring insulation materials. Other applications developed for the solvents include cleaning of electronic instruments, and use as safe, efficient heat transfer agents in low-temperature laboratory chill baths. Another potential use is as an additive to other, more dangerous, solvents to decrease the latter's flammability, or to change their solvency or boiling point properties for special applications.

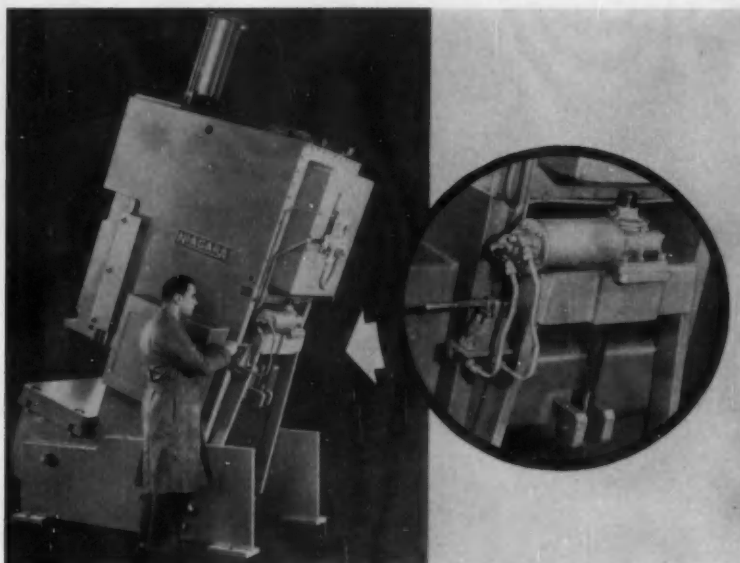
Three types of the solvents are available: "Freon" MF, with a boiling point of 75 F; "Freon" BF, which boils at 199 F; and "Freon" TF, whose boiling point is 118 F. This range, the company explained, makes them adaptable to use in many types of mechanical cleaning equipment. *E. I. du Pont de Nemours & Co.*

Circle 51 on postcard for more data

## Pallet Lifters

**T**HE addition of a line of pallet lifters with adjustable forks has been announced. The adjustable forks add to the versatility of the lifters by handling varying pallet widths. The fork bars adjust like a fork truck; no tools are required; the locking pins hold the forks in position at small increments.

Hanging level loaded or empty, the lifters are designed to handle uniformly loaded pallets, with the load center of gravity directly under the



Niagara Series E press equipped with the new air motor inclining device. A close-up of the device is in inset at right.

## Air Motor Inclining Device for Presses

**N**OW available as optional equipment on the company's series E, A and AA (45 to 200-ton) OBI presses, is a fast-acting air motor inclining device. Easily operated with a hand valve, it is stated to be especially suitable for presswork requiring frequent die changes.

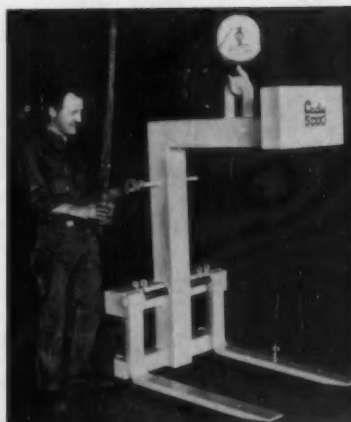
An air motor drives the inclining nut through a high ratio worm gear

to move the press frame up or down. With a shop air pressure of 80 or 85 psi, the press can be either inclined or brought upright over the full range in about two minutes. For maximum safety, the device is self-locking to keep the press from dropping through air failure or line breakage. *Niagara Machine & Tool Works.*

Circle 53 on postcard for more data

pickup lug located at the center of length of the forks. This series is made in two and three-ton capacities as standard. *Cady Metal Fabricating Co.*

Circle 52 on postcard for more data



Cady pallet lifter with adjustable forks

## Phosphating Compound

**I**DENTIFIED as CrysCoat LT, a zinc phosphating compound for use at low temperatures in spray washing machines has recently been developed. The new material is said to produce a fine-grained uniform coating which meets specifications MIL-C-490A, Grade I, and MIL-C-16232A, Type II, calling for coating weights between 150 and 300 mg per sq ft on steel surfaces; with similar coatings being obtained on zinc.

Designed for application in five-stage washing machines, the compound is stated to give quality coatings at temperatures between 120 and 140 F. It is also reported that the coating develops rapidly, including surfaces in deep cavities, thus minimizing rusting difficulties; that the solutions are easy to control; and that sludging problems are minimized. *Oakite Products, Inc.*

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Sometimes you can guess at torque... **BUT**



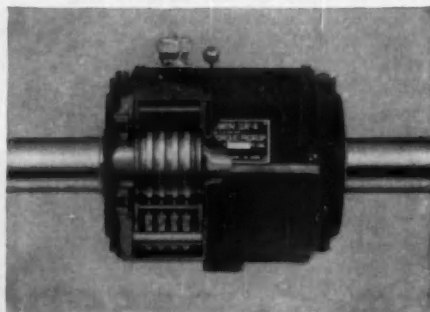
**With SR-4® Torquemeters, you can measure and control  
all industrial torques to  $\pm 1/4\%$  accuracy**

It isn't necessary to measure the exact amount of torque in order to wring out a dishcloth. But in industry, it's often vital that the exact amount of torque on a shaft be known.

You can use Baldwin SR-4 Torquemeters to measure a few inch-ounces or thousands of foot-pounds, and with consistent accuracy to within  $\pm 1/4\%$ . They convert torsion changes directly into changes in electrical energy, measure torque independently of speed, and take no power from the drive shaft. A wide variety of instruments can be used with SR-4 Torquemeters, ranging from millivoltmeter and battery to a computing instrument reading horsepower directly.

Baldwin SR-4 Torquemeters offer unlimited application opportunities. Present uses include torque measurement of viscosity, in engine dynamometers, for pump testing, in propeller drive shafts and helicopter rotor assemblies, and hundreds of other applications in design and production testing.

Whatever *your* torque measurement problem, a B-L-H representative is ready to serve you. For more complete information on SR-4 Torquemeters, write today for your free copy of Bulletin 4308.



The Type A SR-4 Torquemeter is a self-contained unit with housing and brush assembly suspended on a shaft by ball bearings. It employs SR-4 Bonded Wire Strain Gages in a Wheatstone bridge circuit. Baldwin torquemeters have been built for shafts from  $1/4$  in. diameter to 18 in.; for zero rpm to 35,000 rpm; and from 10 in.-oz. capacity to 4,200,000 in.-lb.

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Electronics & Instrumentation Division

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## FREE LITERATURE

### Plastic Forming 1

The VacTrim machine which combines vacuum forming, drape and plug forming, and automatic trimming of thermoplastic sheets in one unit, is described in a four-page brochure. *Vacuum Forming Corp.*

### Phenolic Materials 2

Brochure CDC-322, 12 pages, includes technical data on phenolic molding powders, rubber phenolic molding powders, phenolic laminating varnishes, and industrial and foundry resins. *General Electric Co.*

### Grinder Applications 3

Fourteen unusual surface grinding applications performed by leading metalworkers are graphically described in a booklet called "Case Histories." *Mattison Machine Works.*

### Press Welder 4

Bulletin 3-513, eight pages, describes the Type EQB, size 3½ press welder which is now being produced as a standard model. *The Taylor-Winfield Corp.*

### Air Compressors 5

Showing a complete line of small air-cooled compressors for industrial, automotive, commercial and general use, bulletin AC-15, 16 pages, also includes application data. *Gardner-Denver Co.*

### Casting Alloys 6

The latest list of standard designations and chemical composition ranges for heat and corrosion-resistant cast alloys has been issued by *Alloy Casting Institute.*

### Special Fasteners 7

Cataloged and briefly described in a 16-page booklet are 128 special fasteners of various types. *Buffalo Bolt Co.*

### Torch 8

A torch which uses a d-c welding machine and compressed air in the cutting, gouging, beveling or grooving of metals is featured in four-page folder 6-1. *Arcair Co.*

### Aircraft Switches 9

Catalog 78, 32 pages, covers a complete line of phenolic-encased aircraft switches, auxiliary switch actuators, and terminal enclosures. *Micro Switch Div., Minneapolis-Honeywell Regulator Co.*

### Storage Batteries 10

High-output, sintered-plate, nickel cadmium storage batteries are described in Bulletin 501, eight pages, which includes details of development, construction, and operation along with curves of discharge and charge characteristics. *Nickel Cadmium Battery Corp.*

(Please turn page)

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### Teflon-Lined Pipe 11

A two-page bulletin, T-100, discusses the application of Teflon as a liner for schedule 80 steel pipe. *Halo-carbon Div., Hoveg Industries, Inc.*

### Autotransformer 12

Bulletin 0 describes a line of adjustable autotransformers and includes dimension drawings and complete specifications for all models. *General Radio Co.*

### Fasteners 13

Stainless steel fasteners, including government specification aircraft bolts, slotted and Phillips machine screws, flat and round rivets, and washers, are described in a 12-page catalog issued by *Allmetal Screw Products Co., Inc.*

### Strain Gages 14

A new price list on strain gages, instruments, and accessories, which includes a new line of flat-grid, fine-pitch, bakelite gages, has been issued by *Electronics and Instrumentation Div., Baldwin-Lima-Hamilton Corp.*

### Conveyor 15

Bulletin 285 BH describes various types of conveyor systems designed to solve drum and barrel handling problems. *Conveyor Systems, Inc.*

### Molded Rubber 16

A four-page brochure contains dimensions and descriptive information on typical, extra-large, hard rubber products which may be compression or transfer molded on 400- and 600-ton presses. *Stokes Molded Products Div., Electric Storage Battery Co.*

### AI Index 17, 18

Check 17 on postcard for index to Vol. 115 (July 1 to Dec. 15, 1956) of *AUTOMOTIVE INDUSTRIES*. A limited number of copies of the index to Vol. 114 (Jan. 1 to June 15, 1956) are also available. Check 18 if you wish this index also. *Automotive Industries.*

### Caps and Fillers 19

An illustrated 16-page brochure on caps and filler necks provides concise engineering data for various fluid tank installations. *Stamping Div., Eaton Mfg.*

### Cranking Switches 20

A new line of magnetic cranking switches designed for use on trucks, buses, off-highway vehicles, and industrial and marine equipment is described and illustrated in a catalog sheet issued by *Leece-Neville Co.*

### Fork Truck 21

A four-page folder describing an electric-powered fork truck with 2000 lb capacity, which is specifically designed for use in places where headroom is low, has been issued by *Elwell-Parker Electric Co.*

### Socket Screws 22

Microsized socket screws, especially designed for electronic equipment, industrial and scientific instruments, and other precisely built, compact products, are covered in a four-page folder published by *Standard Pressed Steel Co.*

### Cutting Tools 23

Catalog 601, 12 pages, contains information on solid carbide end mills, carbide rotary cutters, counter sinks, and special tools. *M. A. Ford Mfg. Co.*

### Industrial Ceramics 24

Catalog 57, 20 pages, contains descriptive material and engineering data on a complete line of industrial ceramics, and includes a selection chart listing mechanical, physical, and electrical properties. *Star Porcelain Co.*

### Air Hammer 25

Catalog AR-4C describes a 4½ lb air hammer which features precision impact control and is capable of 5400 blows per minute. *E. V. Nielsen, Inc.*

### Testing Instruments 26

Bulletin 138, two pages, covers a line of combustion-testing and air-measurement instruments. *General Scientific Equipment Co.*

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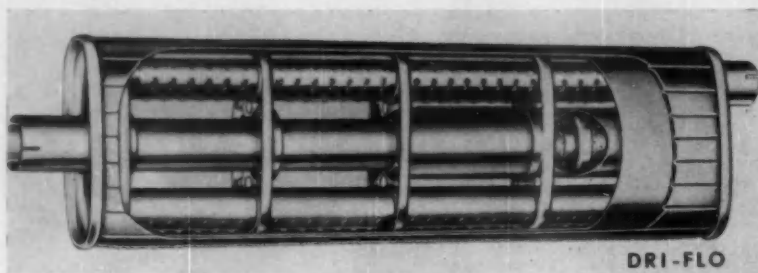
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# NEW

# PRODUCTS

## AUTOMOTIVE-AVIATION

FOR ADDITIONAL INFORMATION, please use reply card on PAGE 89



### Exhaust Muffler Design

The development of an automotive muffler design that is said to make the company's mufflers last up to 25 per cent longer by greatly decreasing exhaust gas moisture condensation within the muffler, has been announced. Called Dri-Flow, the new design is reported to avoid corrosive cold spots and hot spots. Cold spots are defined as those chambers where only a small portion of the exhaust gases may flow and where condensation can occur because these chambers do not get sufficient heat to keep the moisture in suspension. Hot

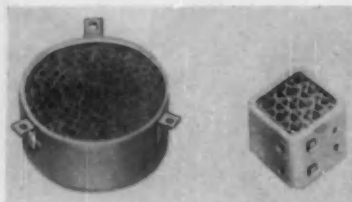
spots are defined as those areas or chambers where the major flow of exhaust gases is normally concentrated.

The disposition of interior elements of the Dri-Flow muffler is illustrated. This arrangement is claimed to eliminate cold spots and hot spots because it uniformly distributes heat by a constant even flow of exhaust gases throughout the entire muffler interior; while maintaining the same or better levels of silencing and back-pressure. *The AP Parts Corp.*

Circle 60 on postcard for more data

### Small Air Filters

Announcement has been made of a line of air filters for providing clean cabinet ventilation to electronic equipment. Their sizes range from 2 by 2



by 2 in. to 2 by 2 by 8 in. A round type, 2-in. by 3-in. diam, is also available.

These miniature units are of the permanent metal type, and are said to have a herringbone-crippled media design that permits the progressive loading of dirt through the entire

filter without face loading to impede air flow. The media design is stated to permit quick cleaning in water.

It is also announced that additional sizes and shapes will become available as needed by the electronics industry. *Farr Co.*

Circle 61 on postcard for more data

### Sintered Iron

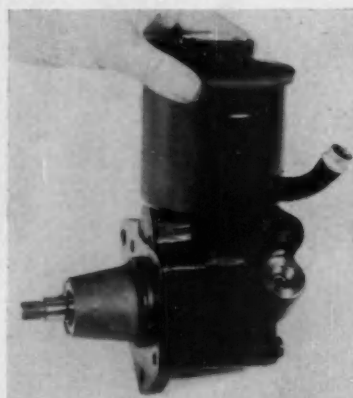
Featuring excellent machining properties with low cost, a pure sintered iron material called Powdiron FM is said to give a mirror-like surface finish, comparable to mild steel, after machining. It does not contain copper. The material is also claimed to have high ductility, and to lengthen tool life over ordinary sintered iron, including iron-copper. *Bound Brook Oil-Less Bearing Co.*

Circle 62 on postcard for more data

### Power Steering Pump

Designed for passenger car and truck applications, a belt-driven oil-hydraulic power steering pump recently announced utilizes an integral regenerative supercharged system which is said to permit operation of the pump to speeds of 7150 rpm. Identified as Model VT-27, the vane type pump features interchangeability of the rotating group, giving dual capacity to the package. It can use either a four or five gpm insert type ring. Capacity is rated at 1200 rpm. Another feature is the use of a pressure-lubricated sleeve type bearing.

The pump also contains a supple-



mental flow control feature which is integral with the pump housing. This device is said to provide a flat delivery curve through normal operating speeds, with diminished delivery at high speeds for less power loss and cooler operation. A 27 cu in external reservoir is mounted on top of the pump housing.

Weighing 10½ lb exclusive of pulley and bracket, the pump measures 3 7/16-in. housing length and 6½ in. over the shaft. The mounting bracket contains provisions for adjustment of belt tension. Pressure connection is SAE inverted flare-type fitting for ¾-in. diam hose; return connection is for clamp-on hose. *Vickers, Inc.*

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## Torque Converter

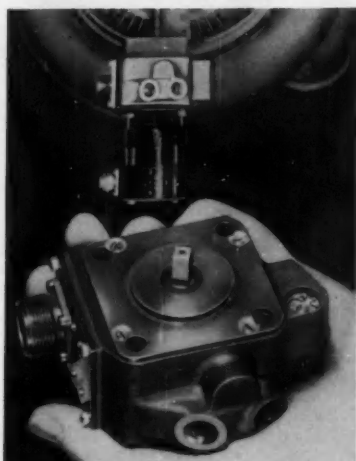
Reversing without gear shifting is featured in the introduction of a torque converter called Revers-O-Matic Drive. A single lever changes both direction and speed of travel. Movement from the neutral, or center, position engages the hydraulically-operated clutch at engine idle speed—either forward or reverse—and further movement controls speed. Two foot pedals may be substituted for the lever when it is advantageous to leave the operator's hands free.

It is said the converter multiplies engine torque more than 200 per cent, and that the drive is adaptable to equipment with engines up to 250 cu in. displacement. *Funk Aircraft Co.*

Circle 64 on postcard for more data

## Speed Regulator

Recently announced was the development of a speed governor and tachometer switch that may be adaptable to a variety of speed regulation



needs. Possible applications given by the company include speed regulation of auxiliary power units; overspeed sensing for emergency engine control systems; speed regulation of, or overspeed protection for, turbo pump sets; helicopter rotor speed sensing and control; and sequencing and control of remotely-operated engines. It has been designed for a direct-through drive, making it possible to mount a tachometer on the governor. This also makes it possible to install the governor on any engine which now has a tachometer pad.

The unit is essentially a one-speed governor which has been preset to cut in at a particular speed. When this

speed has been reached, the governor will cut in in proportion to the increase in speed above this point. A total increase of 7 per cent of the set speed is required to reach full cut-in.

The device has been made for the direct throttling of a propellant to a gas generator and also for the throttling of JP-4 on small engines. It has been run as a pneumatic governor,

working with compressor discharge pressure or high-pressure nitrogen. Provision has been made for the inclusion of a two-way servo valve which makes it possible to actuate a power piston directly from this governor.

The built-in subminiature micro-switches will signal underspeed, on speed, and overspeed. *The Lee Co.*

Circle 65 on postcard for more data

## Cold Finished Steel

A cold-finished steel with the strength properties of many hardened and tempered types, and with good machinability, has been announced. The new material is offered under the trade designation "Fatigue-Proof," and is produced by a new, patented process called elevated temperature drawing, in which the bars are drawn at a temperature significantly above room temperature, but below the lower critical point. It should have special interest for the designer in the automotive field for parts to be machined to form, and requiring good strength, for which final heat treating is not desirable.

The steel is in the medium carbon range, with manganese content carried rather high. The nominal composition is as follows:

Carbon	0.40-0.48%
Manganese	1.35-1.65%
Phosphorus	0.04% max.
Sulphur	0.24-0.33%
Silicon	0.15-0.30%

Physical properties on ground and polished material is as follows:

Tensile strength—	
140,000 psi min.	150,000 psi avg.
Yield strength—	
125,000 psi min.	140,000 psi avg.
Hardness—	
30 Rc min.	32 Rc avg.

The minimum values shown are specifiable minimum, while the averages are those for a year's production. Machinability is approximately 80 per cent of that of B 1112 steel.

The combination of high strength

without additional heat treatment and good machinability indicate the possibilities of the material for parts to be produced by screw machine operations where subsequent heat treatment is not possible, or where subsequent heat treating may result in many rejects because of warpage. The material is produced at the mill with a high finish, and so would be a choice for shafting or similar parts where it could be used with little or no additional processing.

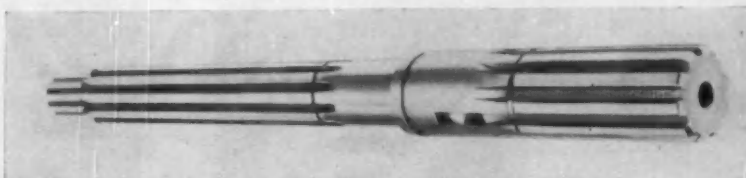
As the high physical properties are the result of mechanical working, they would be lost in forging or other hot operations. The carbon and manganese content are sufficient to give the material a good response to hardening where local heat treatment, such as induction hardening, is desired. Sulphur content is kept high to insure good machinability, so that weldability is limited.

Tests have shown that "Fatigue-Proof" retains its strength in elevated temperature service up to about 600 F, but that exposure to higher temperatures results in loss of strength and hardness.

Additional cold working is possible to a limited degree, according to the suppliers, but difficulties are such as would be encountered in cold working any heat treated or severely cold worked steel. Threads can be rolled successfully on the material.

Fatigue strength, shown by tests with unnotched specimens in rotating beam testing machines, is comparable to that of heat treated steels, it is reported. *La Salle Steel Co.*

Circle 66 on postcard for more data



Parts such as this splined shaft can be produced economically from Fatigue-Proof steel as they require no heat treating.

# Annual Meeting of the SAE

(Continued from page 67)

## The General Motors Fuel Injection System Basic Development

By John Dolza  
General Motors Corp.

### G.M. Metering System

FUEL supplied by a conventional six psi diaphragm pump (Fig. 1) passes through a ten micron primary filter to the fuel meter. The fuel is admitted through a float valve—similar to its counter part in a carburetor—into the float chamber where any vapors which have formed due to temperature rise are vented. A small gear pump located in the bottom of the float chamber delivers the fuel thru a second inlet filter and a fuel valve to the metering cavity (Fig. 2).

The fuel valve contains an anti-percolation ball check to keep the fuel between the valve and the pump at a sufficiently high pressure to eliminate vapor pockets. Some of the fuel delivered to the metering cavity flows directly to the eight continuous spray nozzles; the remainder of the fuel flows through the spill ports back to the float chamber. The amount of fuel spill is regulated by the spill plunger.

The air enters the air meter through the annular venturi section and flows past the throttle blade to the manifold header and then to the individual intake ports. The air velocity through the venturi causes a depression signal related to the mass air flow. This venturi signal acts on the control diaphragm to create a force which is transmitted to the spill plunger by means of the diaphragm link and control arm, the latter being pivoted on the ratio lever.

An increase in air flow through the venturi causes a relative increase in venturi signal which, acting on the control diaphragm, results in an increase in the force acting on the top of the spill plunger. The spill plunger then moves to a new balanced position to obtain a fuel pressure increase proportional to the venturi signal increase. Since the increased fuel pressure results in a fuel flow proportional to the increase in air flow indicated by the venturi signal, a constant air-fuel ratio will be maintained as long as the linkage ratio is not changed.

The air-fuel ratio can be varied by changing the linkage leverage between the control diaphragm and the spill

plunger. This is accomplished by shifting the pivot point on the control arm. When the "ratio lever" rests against stop "P" (Power), the air-fuel ratio obtained is for wide open throttle operation; when resting against stop "E" (Economy), part throttle fuel requirements are fulfilled. For automatic operation, the ratio lever is controlled by the spring loaded enrichment diaphragm which is subjected to manifold vacuum; at light load (high vacuum) the lever is held at position "E", at full load (low vacuum) at position "P".

The stops are set to obtain a best economy air-fuel ratio (about 15.5:1) at part throttle and a maximum power air-fuel ratio (about 12.5:1) at wide open throttle. The enrichment diaphragm spring is set to hold the ratio lever in the economy position above about seven inches mercury vacuum.

The nozzle (Fig. 3) has an accurately calibrated open fuel orifice somewhat less than 1/64 in. diam. The nozzles are mounted, at the entrance of each intake port, in plastic nozzle holders. Just below the fuel orifice, there is a small air chamber which receives filtered air thru four 0.100 in. diam air holes from the air

(Turn to page 96, please)

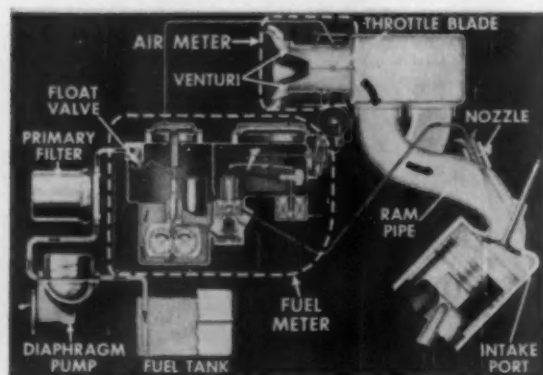


Fig. 1—GM fuel injection system

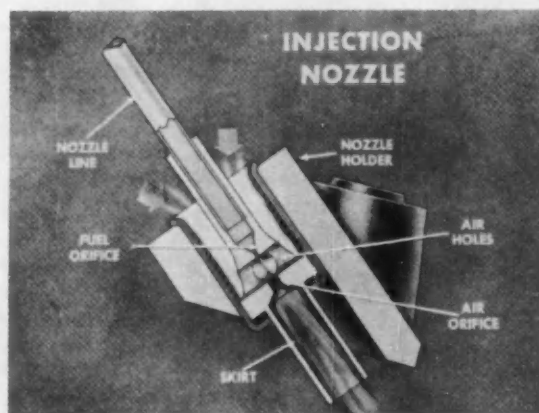


Fig. 3—Injection nozzle

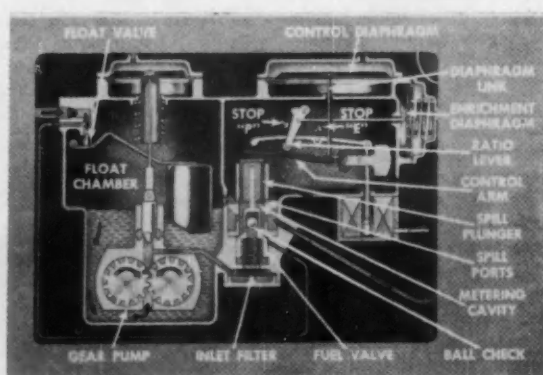
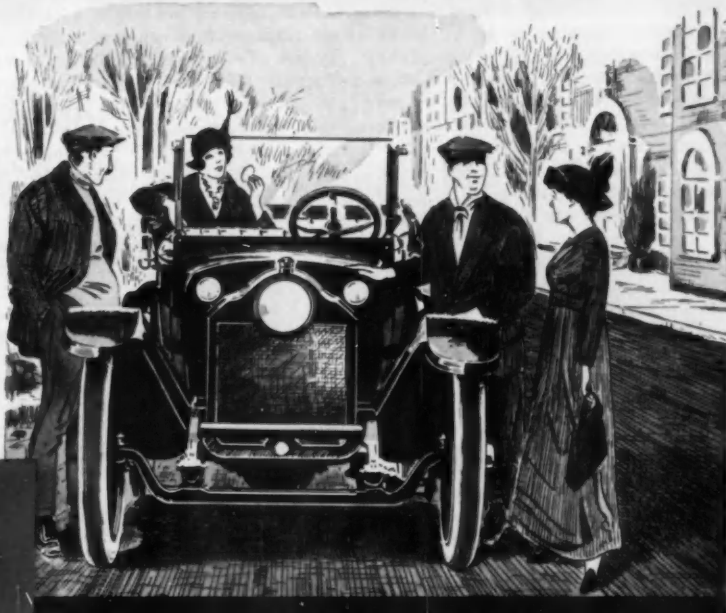


Fig. 2—Fuel meter

# When Compression Ratios were 3 to 1 ...any good oil ring would do!

Remember the Cyclops-eyed Garford, vintage 1913? Besides boasting the distinction of a single electric headlight, the Garford featured an electric starter, electric horn, a 1-piece all-steel body, left-hand drive, a 3-speed transmission and a 60 H.P. long-stroke engine. Later, this car evolved into the Studebaker-Garford.



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# Annual Meeting of the SAE

(Continued from page 94)

cleaner. This air supply assures that the nozzle discharge is at all times near atmospheric pressure regardless of manifold vacuum fluctuations, and consequently the amount of fuel injected depends solely on the metering system pressure. In line with the fuel orifice across the air chamber is the opening to the intake port. This is a 0.040 in. diam air orifice. It should be noted that under all manifold vacuum conditions, the atomization of fuel is enhanced by the mixing of air and fuel thru this 0.040 in. orifice. The air volume passing thru the air orifice represents about one-fourth of air used at closed throttle for idling.

The tubular skirt below the air orifice is cooled by evaporation of the fuel which in turn cools the fuel line by conduction, thus preventing metering disturbances caused by fuel vapor bubbles. In fact, the fuel at the nozzle

and in most of the line is at a lower temperature than when it entered the system from the diaphragm pump. By using this scheme of refrigerating the fuel by means of its latent heat, this open orifice type of nozzle becomes suitable for handling high vapor pressure fuel even under summer conditions.

The fuel orifice size was selected to give a minimum pressure at idle and cranking of about eight inches fuel head and a maximum pressure of the order of 200 psi at engine top speed and wide open throttle. Under normal driving conditions, the pump pressure seldom exceeds 20 psi. These moderate pressures can be achieved with a plain gear pump. The fuel pressure at idle and when starting has been found sufficiently high to prevent adverse distribution effects caused by normal engine attitude changes.

## Quality Car Structure

By G. J. Englehard

Chevrolet Div. of General Motors Corp.

**T**HE number of places required for mounting the body to the frame varies according to the particular

frame and body design. Some designs require more and some fewer mounts. For exploratory purposes, experimen-

tal test cars are often built with more body-to-frame mounts than are actually believed necessary. In a given design, if a mounting is found to be ineffective in carrying loads, its use cannot be justified.

Elimination of such body mounts on an experimental test car, identified by light shaded mounts (Fig. 1), was found to reduce the torsional rigidity by only six per cent while the maximum bending deflection was increased by only 0.006 in. Road tests run later without these mounts disclosed the rigidity to be within satisfactory limits and the road noise to be substantially reduced. In order to determine the effectiveness of body mounts, a procedure has been devised to measure the amount of load imposed on body mounts during standard bending and twist tests.

A load cell (Fig. 2), utilizing strain gages, is placed between the body and frame at each of the body mount locations. As the bending or torsional test load is applied, resulting body mount loads imparted to the load cell cause a galvanometer to indicate readings proportional to the loads on the load cells. By calibrating the galvanometer in pounds, tension or compression loads are determined at each body mount. Mounts carrying insignificant loads in both the bending and torsion tests can thus be eliminated. The effects of altering the number of mounts are evaluated later during tuning adjustments under dynamic road conditions.

(Turn to page 120, please)

Fig. 1—Body mount locations on Chevrolet sedan test car. Eliminating light shaded mounts resulted in insignificant stiffness loss

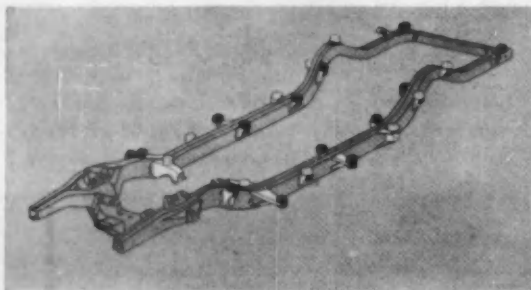
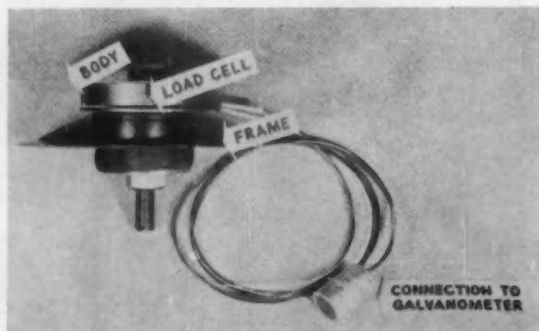


Fig. 2—Load cell used at each body mount



**THEORY OF LAND LOCOMOTION**, by M. G. Bekker, published by The University of Michigan Press, Ann Arbor, Mich. Price, \$12.50. This is a highly technical treatise on the relations between motor vehicles and the physical environment in which they operate. The author, Technical Director of the Land Locomotion Research Laboratory, Detroit Arsenal, has attempted to lay the foundation for a new

## BOOKS ...

type of applied mechanics by systematizing the accumulated experience of engineers, designers, technicians, and produc-

tion men in the automotive field. Placing particular emphasis on off-the-road vehicles, the book discusses in detail problems of soil and snow mechanics; size-form relationships as an index of economy; terrain conditions; moving tracks, skis, sleds, toboggans, rigid wheels, and pneumatic tires; static and dynamic behavior; dimensional analysis, testing, and overall economy.



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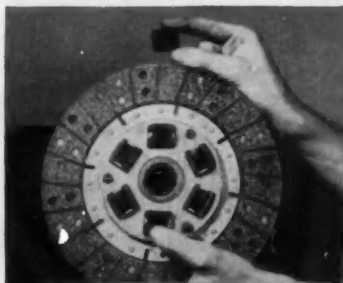
14 YEARS' EXPERIENCE PROVES

### NEOPRENE blocks promote clutch-plate efficiency

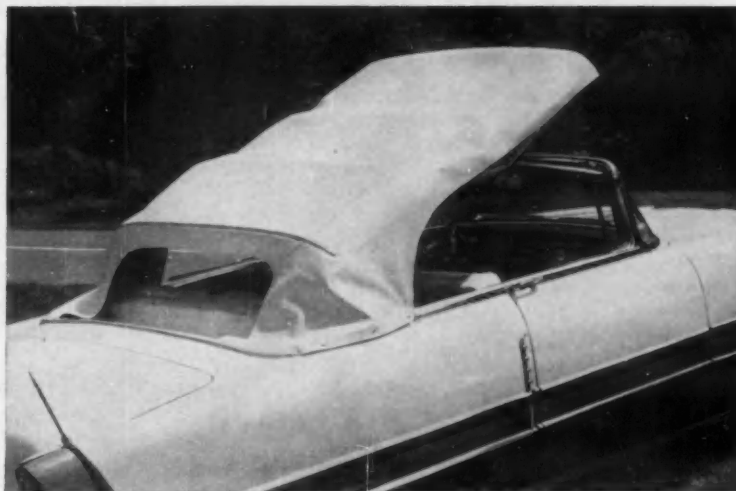
For over fourteen years, taxi and truck fleets have been road-testing a new type of replacement clutch plate—one in which resilient blocks of neoprene have replaced conventional metal springs. Results indicate a vast improvement in over-all clutch performance, and maintenance costs have been reduced nearly 50%.

In operation, the neoprene blocks smoothly transmit the torsional force of the clutch. They retain their elasticity for longer than the life of the clutch facing, despite constant flexing and exposure to heat and oil. And cab drivers report there's less lost motion in the drive line—no clutch "chatter"; no trouble with springs breaking or coming loose. The result is more efficient clutch operation and reduced abuse of clutch facings.

It's an outstanding example of design improvement made possible with neoprene, Du Pont's synthetic rubber. Why not see how you can use Du Pont's neoprene to help solve your problems? Just clip the coupon for full information.



Small as they are, these neoprene blocks do a big job as replacements for conventional metal springs. Clutch operation is smoother, quieter, more efficient.



Coating of **HYPALON** stays flexible in cold weather, washes easily with soap and water.

**Longer service life.** There are many reasons for coating convertible tops with HYPALON, Du Pont's new synthetic rubber. HYPALON coatings stay flexible at low temperatures, and they will not crack after prolonged exposure to all kinds of weather. They possess exceptional resistance to sunlight. And they can be compounded in an unlimited range of light-stable colors.

**Soap-and-water maintenance.** HYPALON coatings also have superior resistance to soiling. They are inherently resilient and do not develop a sticky surface to hold dirt and dust. If HYPALON coatings do become dirty, they can be washed easily with soap and water with no harmful effects.

**Manufacturing Advantage.** Many other materials wrinkle and crease permanently when folded, but HYPALON synthetic rubber coatings return more readily to their original smooth surface. The HYPALON-coated convertible top also tailors and trims better in manufacture.

**Investigate HYPALON.** HYPALON is being used by the automotive industry in other items such as spark-plug boots, door stripping and white side-walled tires. Its exceptionally high resistance to ozone, heat, chemicals and outdoor exposure offers still more automotive design possibilities. Just clip the coupon below for more information on the properties of HYPALON.



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# METALS

*Steel Operating at Near Capacity as Prices Continue to Rise. Copper Sales Improve Slightly; Nickel Still in Short Supply*

*By William F. Boericke*

## **Demand Heavy For Plates and Structural**

Starting on the first of the year steel mills will operate on the basis of an annual capacity of 133,460,000 net tons, an increase of 5 million tons over 1956. This brings steel making capacity nearly 50 per cent higher than 10 years ago. Total production in 1956 was 115,200,000 tons, second highest production on record. The year would have established an all-time high had it not been for the loss of 11 million tons during the steel strike.

Incoming orders for most steel products equalled or exceeded shipments in January. Broadly speaking, the mills are booked satisfactorily for the first quarter, but more caution is shown in projecting for the following months. Much depends on demand from Detroit. The mills would be happier if the call for cold-rolled sheets would pick up. Another disappointment is the slow rate of orders from the appliance makers, whose inventories appear to be higher than expected.

On the other hand, plates, structural shapes, and pipe are very hard to obtain. These are vitally needed for the oil industry, for shipbuilding, freight cars, and general construction. The emphasis on tanker construction, because of the Suez crisis, has alarmed regular users, who are threatened with loss of some of their scheduled supplies.

## **Capacity Operations For First Quarter**

To date, any cancellations or deferment of delivery of steel to Detroit has caused little concern to the steel mills because other customers were waiting eagerly to take up the slack. The moot question is how long this will continue. While inventories are believed to be generally low, there is no positive data available. Warehouse stocks, except for plates and structurals, are thought to be ample. Auto producers declare they have enough steel for current production and with steel peace assured this year, they are not anxious to load up.

There is no prospect of any immediate slump in

production rate, but there is a growing belief that a decline from present near-capacity may occur earlier than forecast in some of the roseate estimates for the new year. This could work out all to the good for the mills in giving them better opportunity to catch up on needed repairs after the hectic pace of 1956.

## **Some Price Increases**

Late in December, Colorado Fuel & Iron boosted its price for carbon steel plates by \$7 a ton. Crucible Steel and Allegheny Ludlum hiked base prices on stainless steel. This action was promptly followed by U. S. Steel, usually the bellwether in instituting price changes in the industry. There followed a deluge of increases in extra charges on nearly all steel products to reflect the cost of special processing. Increases amounted to about \$2 per ton.

Rejection by the Government of rapid amortization for cost of new steel plant expansion has undoubtedly served to speed up price increases. Wage scales have automatically been raised with the cost of living index, and a hike in the iron ore price is believed on the way. Most steel customers will accept higher prices without undue protest, with the possible exception of cold rolled sheets and merchant wire which appear to be in adequate, if not easy, supply.

## **Scrap Declines**

Prices for steel scrap began to decline in late December. By mid-January they had fallen as much as \$4 per ton in Pittsburgh. Heavy melting scrap was offered at \$63. Steel mills welcomed the drop from what was termed an unrealistic level. Yet there was an uneasy feeling that the decline might forecast a downturn in the rate of steel production as it has often done in the past. But this is hard to reconcile with the glowing accounts of capacity business for the first quarter. However, the outlook is for further weakness in scrap prices.

## **Copper Steady, Brass Mills Slow**

By mid-January a slight improvement in copper sales was evident, at least to the optimists. Producers still held to their 36-cent price but the custom smelters were quoting 35-35½ cents. On the London market copper see-sawed around the 34-cent level. The producers' attitude is that no more metal could be sold by

*(Turn to page 104, please)*



## The ring of quality

Colorful, low-cost sidewall rings that can be quickly installed on tires are now contributing to the luxury-look of today's new cars. They're inexpensive, stay brilliant for life, wash bright in seconds, out-last tires. A product of The Bearfoot Sole Co., Wadsworth, Ohio, these rings are available in a variety of colors or in white. They're made of Enjay Butyl Rubber because no other rubber tested could equal its performance in severe laboratory and road tests. The Enjay Butyl label on the Flex-A-Wall® carton assures the buyer of outstanding quality.

Find out for yourself the many technical advantages of Enjay Butyl—the rubber that is outperforming natural and other types of rubber in a wide variety of industrial and consumer applications. For full information, and for technical assistance in the use of Enjay Butyl, write, wire or phone the Enjay Company.



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# Observations

By Joseph Geschelin

## Crankshaft Progress

The SAE session on forged and cast crankshafts brought out some interesting ideas in private discussion. For one thing more producers are turning to press forging which is by no means a new art. We learned too of the possibility that one of the shell molded shafts now in production may be shifted back to forging. Since the meeting we have learned that important improvements are in the offing in shell molding techniques, resulting in still closer control of dimensional tolerances. This improvement is so large as to encompass the possibility of rolling bearing and journal diameters to size and excellent surface finish. This would also produce a work hardened bearing surface of greater durability.

## Micro Honing

In a recent press conference Micro-matic Hone divulged advance details of new fully automatic honing equipment that may revolutionize the finishing of ball ends, spherical details, and ball bearing inner and outer races. Microhoning of ball ends is particularly important since it is anticipated that 1958 cars will employ from 14 to more ball joints of various types and sizes. The method is said to produce perfect geometric forms with excellent tolerances and exceedingly fine surface finish.

## Heavy Drives

Considerable work is being done under cover in the area of heavy duty automatic transmissions. In the next few years we expect to see a number of automatic drives suitable for vehicles of the off-highway size. Meanwhile, it is no longer a secret that the Allison six-speed transmission which was developed initially for Chevrolet has been adopted by a leading truck producer outside the GM family and will be used by still another competitor later in 1957.

## Surface Finish

Surface finish specifications have become almost commonplace on engineering drawings. In view of this it becomes important to supply suitable inspection equipment directly at the points where finish is important. As a matter of fact, something should be done to incorporate surface finish inspection in the automatic inspection devices now being built into automatic machine lines.

## Program Anodizing

One of the most important developments in connection with the growing use of aluminum in motor cars is the automatic plating equipment now available. We found recently that one of the aluminum suppliers has in operation an enormous anodizing machine supplied by F. B. Stevens. One of its principal features is an out-sized control board by means of which it is a simple matter to program each individual carrier. What this means is that the single automatic machine can schedule a large variety of different parts, each of which can be subjected to a specific cycle of events. This is a boon to suppliers and users who must handle a large variety of parts for anodizing.

## CO-Two Welding

The latest shielded arc welding process to be exploited in automotive plants utilizes carbon dioxide. A relatively new technique, one of its main features is cost economy since the neutral atmosphere is provided by a relatively low cost material.

## Ceramic Tools

So far Ford Motor Co. is the only in the industry to release details and complete cost analysis of its two major ceramic tool production jobs. And they make mighty interesting reading. Ford insists on a complete cost analysis, thereby proving that the ceramic tool applications had doubled productivity in one case and increased it by 26 per cent in the initial case. It also proves that the first cost of tools means nothing at all. We feel sure that other manufacturers have made progress with ceramic tooling and would be delighted to publish the results.

## Light Control

Evidently something must be done to reduce glare on the highways. We are told that Ohio Turnpike authorities recommend use of the driving beam at all times. This is fine where the two lanes are parallel. But it's murder on turns—and there are turns on these highways. Highway authorities must insist upon dimming the lights if safe driving is to be possible. Incidentally, now is the time to press for development of inexpensive automatic dimming devices. If they began to make their appearance on a majority of new cars, it would take only a few years before many of the cars on the road would be safer at night.

## L.A. Young Acquires Rights For New Type of Truck Body

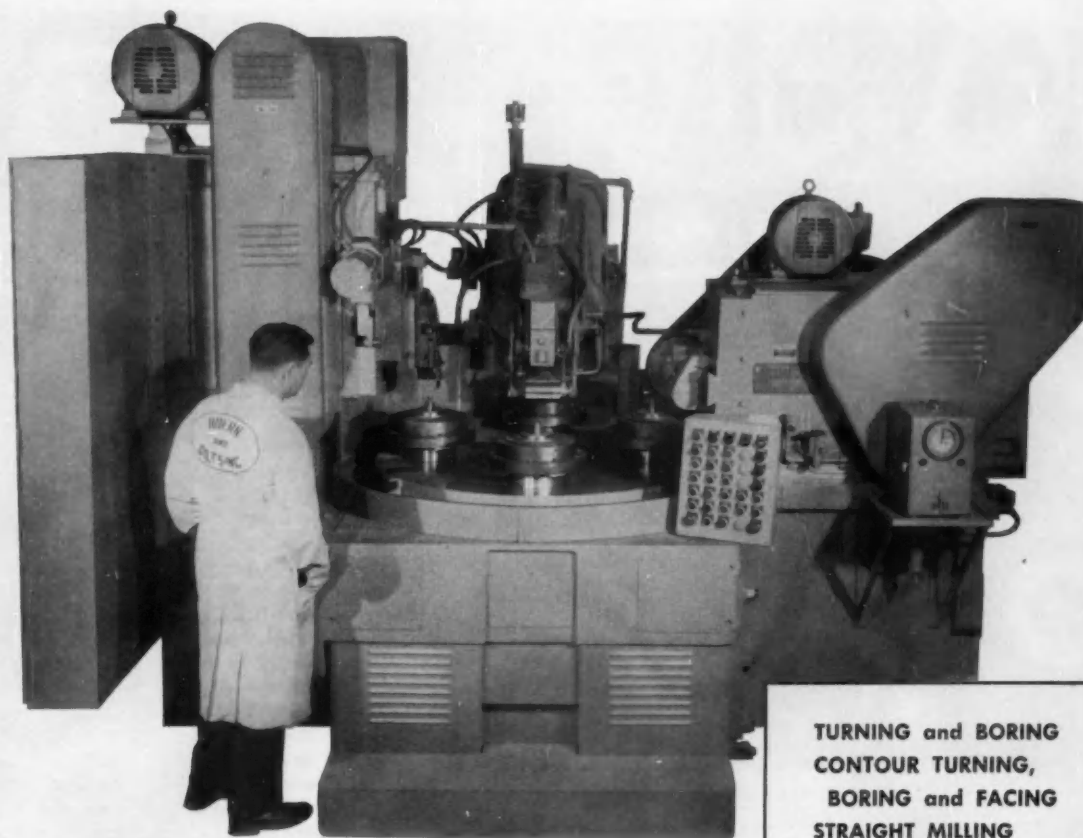
L. A. Young Spring & Wire Corp. has acquired manufacturing and sales rights to a new garbage and rubbish truck body. It will be manufactured by the company's Daybrook Hydraulic Div.

The body features a tailgate assembly, which permits loading and packing in a continuous, automatic cycle without waiting for the hopper to be emptied. Space-saving is possible, since large loads are crushed and compressed.

## AUTOMOTIVE INDUSTRIES . . .

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**TURNING and BORING  
CONTOUR TURNING,  
BORING and FACING  
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PLANETARY MILLING  
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**Indexing Table:** Mounted on pre-loaded roller bearings. Index accurate to .0002". By providing adjacent spindles with proper chucking devices, both ends of a piece may be put through identical or closely related operations.

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A Hoern & Dilts Indexing Finishing Machine handles with *one* chucking and one operator, the operations ordinarily performed by several operators using completely different types of equipment.

This advanced approach to increased, more accurate production is accomplished by arranging a variety of self-contained heads around a central indexing table in which the spindles are mounted. Since all the operations are performed with a single chucking, all the proper relationships are maintained.

Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

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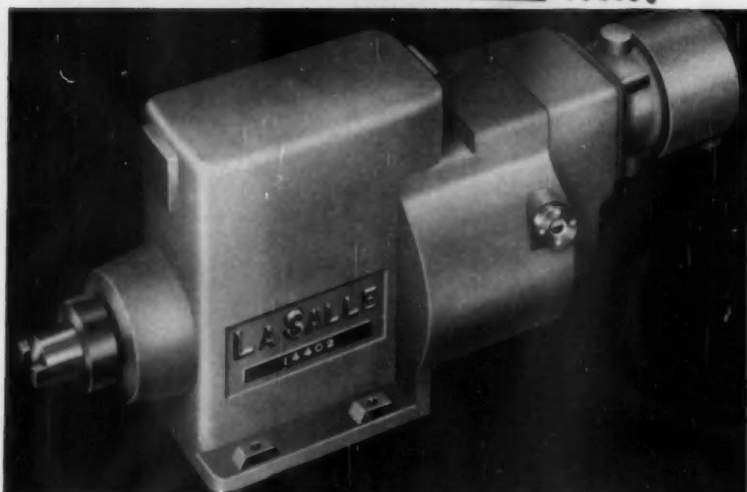
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practically  
eliminates  
breakage  
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## two-speed fully automatic power

It's synchronized with the machine cycle to give you automatic engaging and disengaging of parts. Controlled torque eliminates positively all guesswork in clamping pressure.

**IT'S NEW!**

## operates on machine tool principles

A high speed low torque approach; a low speed high torque clamping; and a low speed high torque break clamp and a high speed low torque return.

**STARTLINGLY  
DIFFERENT!**

## features fluid motor drive

You can clamp light parts or parts with thin-walled areas without fracturing and you can always repeat the clamping torque from cycle to cycle.

**GOOD NEWS  
FOR  
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## fits any type of production machine

They're designed to fit any special or any standard machine in use today—such as Multiple-Drilling Machines, Lathes, Boring Mills, Grinders, Screw Machines or Thread Millers

## unit mounted quickly

The design permits either vertical, horizontal or angular mounting—to serve your particular needs.

## now available in two standard sizes

Smaller model has a torque capacity up to 1200 inch/pounds; larger model from 800 to 5000 inch/pounds. To control and regulate properly a hydraulic power package is provided.

# La Salle tool, inc.

**ENGINEERING & BUILDING SPECIAL MACHINERY**

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## Reducing Camera

(Continued from page 49)

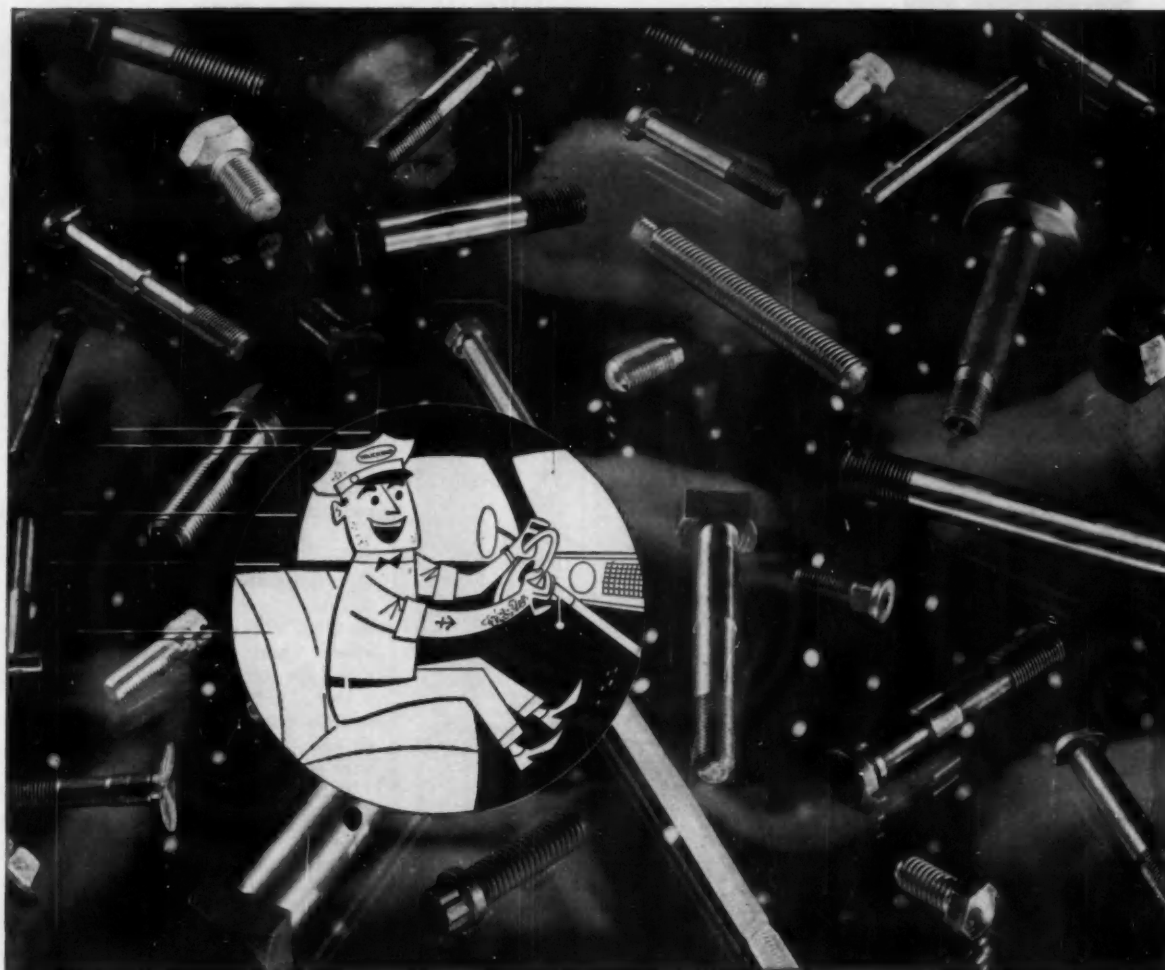
amount of filing space needed, as well as in the use of processing chemicals, water, operating personnel, and everything else involved in the photocopy process. And this includes such operations as folding, handling, collating, filing, mailing and delivering.

Because it has proved so successful, we are now using the Neoflow camera wherever reductions and additional reproductions (blue prints or direct prints) are required. For example, we are reducing vendors' drawings several copies of which must be made available at different points throughout our organization, thus placing a great demand on our photocopying facilities.

We are also using the camera to reduce "EMD's" (Engineering Master Drawings), some of which are drawn on material known as a "Scrib Mylar Base." This material is a plastic, coated with white paint, which permits the scribing of lines into the painted surface. The Mylar original is reduced to half size by the camera and the necessary reproductions made from the half-size negative. Previously, this was accomplished by making a one-fifth size film negative with a process camera from a metal plate and reproducing a one-half size transparency from the one-fifth size negative which would be used to make the necessary reproductions. Making the reduction directly on the Peerless camera and printing one-half size copies, immediately cut the photocopying operation in half and broke a bottleneck in the distribution of releases.

The Neoflow Camera has also proved its worth in the preparation of electrical wiring books. The original engineering tracings are drawn to such a size that when reduced they can be folded neatly into a standard 8½ by 11 in. size report book.

Any type of original vellum, tracing cloth, transparency, Vandyke, Ozalid, blue print, etc., can be processed through the Neoflow Camera to obtain a reduced size transparent copy suitable for additional reproduction by direct print or blue print processes, at a speed at least five times faster than previous methods used. The tracing, Vandyke, sepia transparency or other type of original data is fed through the Neoflow Camera on a continuous flow basis in the same manner as in a blue print or direct print machine.



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### Special fasteners to your requirements

Ferry Cap fills rush requests for custom-made threaded fasteners. That's been our business for 50 years.

To render even better service we will, if desired, "sit in" and help plan fasteners at the time products are designed.

Even if you don't anticipate a fastener problem, we'll be happy to look over your prelimi-

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#### THE FERRY CAP & SET SCREW COMPANY

Makers of the famous Countr-Bor® Screw for socket head applications.  
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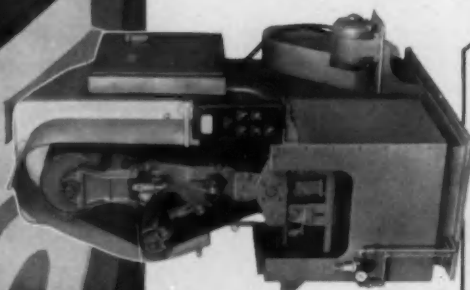
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- ★ Pre-polishes greater area in less time than any contour polishing.
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MICRO-POLISH units may be used singly or in line to suit your needs.



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Murray-Way can give you a single machine or a completely automated production line engineered specifically to your requirements. We welcome your inquiries.

## METALS

(Continued from page 98)

price reduction and they may hold to this position although forced to cut production to balance demand. The custom smelters are situated differently and will not hesitate to cut their price if confronted with heavy offerings of concentrates seeking a market.

Brass mills are operating at 60-70 per cent of capacity and do not expect any substantial upturn immediately ahead. They are facing competition from foreign fabricators who are paying lower prices for copper and zinc and are underpricing U. S. goods by about 10 per cent. Customers are generally buying only for immediate delivery and are unwilling to increase inventories having no fear of lack of metal from suppliers. Tight money and high interest rates are further deterrents against extended buying. Orders from Detroit have continued to be disappointing. On the other hand, business with the wire mills has been good.

Belief that no copper shortage looms in 1957 was strengthened by publication of estimates, by the Copper Institute, that world capacity would increase to 3,505,000 tons—1,190,000 tons from U.S. mines and 2,315,000 tons abroad. This represents an increase of 250,000 tons over 1956. The figures do not include recovery of copper from scrap, which would add another 10-20 per cent to supply.

(Turn to page 106, please)

## BOOKS...

**MANUFACTURING METHODS AND PROCESSES**, by Arthur C. Ansley, published by Chilton Co., Chestnut and 56 Sts., Philadelphia 39, Pa. Price, \$12.50. This book attempts to give the executive, purchasing agent, engineer, and production man a comprehensive survey of the latest developments in manufacturing methods and processes. It describes briefly the methods used in each process, the products to which each one is adapted, and the economics of its use. Although it summarizes conventional manufacturing techniques, the bulk of the book is devoted to explaining the newest developments, such as powder metallurgy, investment castings, plastics, ultrasonic machining, dielectric heating, printed circuits, and automation. A chapter on assembly processes discusses the ways in which substantial savings can be made in this, often neglected, phase of manufacturing. The book is written in non-technical language, and is profusely illustrated.

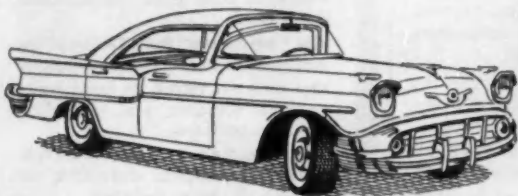


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STERLING'S great "Conformatic" piston with "Intra-Cast" steel ring groove liners give sensationally longer life to rings and grooves—

Recommended clearances for "Conformatic" pistons are from 0 to  $\frac{1}{2}$  thousandth inch. This clearance is maintained hot and cold providing unbelievable bore stability.



Sterling's revolutionary *Conformatic* piston already has been accepted and is now being used in a number of America's finest and most popular passenger cars.

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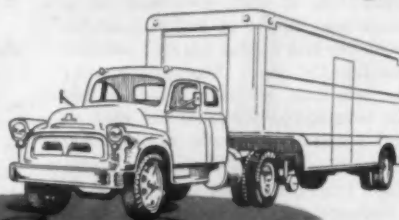
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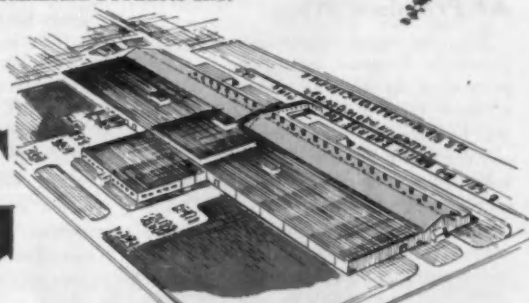
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AUTOMOTIVE INDUSTRIES, February 1, 1957



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prevents frictional horsepower loss, reduces oil consumption to an absolute minimum, and prolongs engine life up to 400%. *Intra-Cast* and *Conformatic* are registered trade names of STERLING Aluminum Products Inc.



### NEW MANUFACTURING FACILITIES FOR STERLING ALUMINUM

120 acres! Completely new automated plant at the confluence of the Missouri and Mississippi Rivers

SA-1

# ... METALS ...

(Continued from page 104)

## Zinc Sales Large, Aided by Stockpiling

Analysis of the latest figures from the Zinc Institute give neither over-much comfort or alarm to producers. Production of slab continued at a record high figure of 98,234 tons for December and totaled nearly 1,063,000 tons for the year. Stockpile buying was less than the month before, but still constituted about 20 per cent of total production. Stocks dipped 1500 tons, but unfilled orders were down 11,000 tons, the lowest since last May.

Government stockpilers did not take all the zinc and lead offered in December by domestic producers, particularly of lead, which is believed to be in a better statistical position than zinc. It now appears that regardless of the original targets set for stockpiling the metals, Government buying will continue well into 1957. Barter deals will become of increasing importance in price support of both lead and zinc. Temporarily, the supply was shortened by the strike on the Canadian Pacific RR, which shut off shipments from important smelters.

A note of warning against high prices for zinc for use in diecasting was voiced by a Chrysler official, who declared that its use in the automotive industry was at a peak unless the price was lowered. Consumption was up eight per cent on 1957 cars, according to the Zinc Institute, with 65 lb used per car. Aluminum diecastings are competitive.

## Nickel Sold At Premium Prices

The increased nickel price was promptly followed by raises in the price of nickel-bearing stainless steels of from  $\frac{1}{4}$  to 6 cents a pound, varying by grade in relation to nickel content. The higher price for nickel will not result in bringing out any increase in output for the metal at present, but it will stimulate renewed search for new deposits as well as speed up development of several properties in Canada that can be expected to produce limited quantities before the end of the year.

In the interim, however, nickel is in very tight supply and likely to remain so. While the official price is 74 cents per pound, sales by outside dealers are reported at \$2.30 per pound. Official announcement has been made that a Canadian producer of

some 4 million lb annual output will divert two thirds of its output to the premium price market at \$2 per pound. Firm contracts are being finalized with both U. S. and European steel firms for monthly sales of 175,000 lb at this figure.

## Aluminum in Oversupply

Aluminum company executives now admit that supply will probably out-strip demand in 1957. But it may be in balance in 1958, they say, and could well be in tight supply by 1960. Aside from the increased production in 1956—amounting to 1,682,000 tons, about seven per cent over 1955—elimination of stockpile requirements increased industrial supply by 650,000 tons.

Purchases by independent fabricators were low as the new year began, and primary metal accumulated with the producers. A tip-off on the situation was the request by Kaiser Aluminum to the Government to sell 10,000 tons to the stockpile. Basis for this request is a contract which requires Washington to buy at the going market price for the next two years any production from facilities built under the war program. Present primary production is estimated about 180,000 tons a month, plus imports and secondary production to add to supply. It seems quite probable that the other aluminum producers will follow Kaiser in "putting" aluminum to the Government. As long as this continues there is little likelihood of any decline in price.

## Texas Tin Smelter Acquired

Wah Chang Corp. of New York has bought the controversial Longhorn tin smelter at Texas City from the Government for an undisclosed amount. It is planned to use a part of the plant for tungsten and manufacture of tin alloys, although tin smelting will be continued on a much reduced scale. It has been the only important tin smelter in the Western Hemisphere and has been of vital importance to Bolivian tin miners.

Tin prices have declined to \$1 a pound after going as high as \$1.13 during the height of the Suez trouble. A featureless market is anticipated, with demand and supply in balance. Tin consumption in U. S. in the first nine months of 1956 was 66,300 tons, with tin plate and solder accounting for most of the demand.

## Streamline YOUR Production Line



with

**DAREX**

**Flowed-in**

**GASKETS**

Better automotive products at lower production cost!

That's the big reason why the DAREX "Flowed-In" PROCESS is automatically replacing slow and costly hand-fitted gaskets ... on so many new parts for so many leading 1957 models. Here are some typical new uses:

**ON FASTENERS FOR CHROME TRIM** to hold trim tighter, seal out water.

**ON "SNAP-IN" PARTS** for plugs and sockets to seal out dirt, fumes.

**ON AIR FILTERS** to bond components together, seal out dirt, abrasive particles.

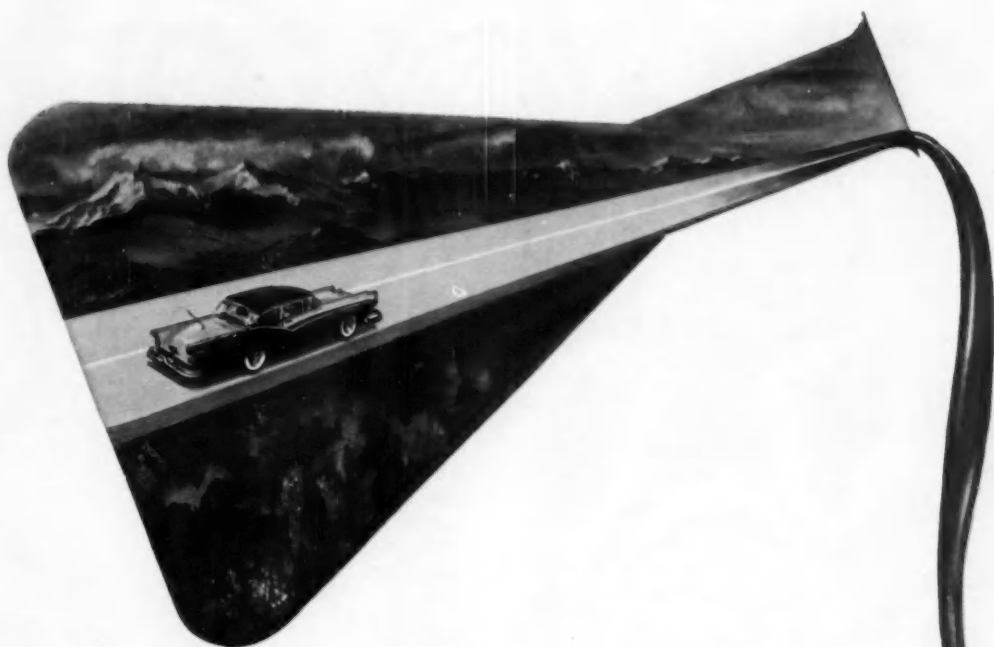
**ON VOLTAGE REGULATOR AND SOLENOID COVERS** to seal out oil, water and dust.

What's *your* mass-production sealing problem? Chances are the DAREX "Flowed-In" PROCESS can solve it ... with just the right compound and application machinery, backed by Dewey and Almy research and technical service all the way. Look into this cost-cutting shortcut to greater product efficiency. Call or write us today.

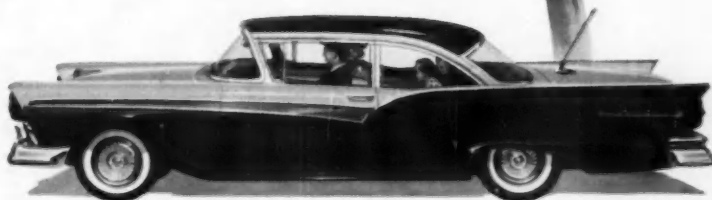
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Through national magazine advertisements like this, Dewey and Almy is helping create still greater acceptance of our customers' goods ... contributing toward their sales as we contribute toward improvement of their products.



## How smooth riding is "poured" into your new FORD!



The "Ford in Your Future" owes a lot of its velvety ride to the DAREX "Flowed-in" GASKETS that seal its shock absorber ends.

In this use, the automatic "Flowed-in" Process takes the place of costly electric welding. DAREX machines *stream* in a special liquid sealing compound. When vulcanized, it forms a solid, rubbery seal that holds up under extreme heat and pressure . . . and helps *hold down* the bumps on the road.

Similarly, DAREX "Flowed-in" GASKETS are lowering labor and material costs and lifting product efficiency

*all along the assembly line . . .* in oil and air filter covers, lamp sockets, crankcases and many other parts.

Although new in these adaptations, DAREX "Flowed-in" GASKETS have been the life's blood of the canning industry for 35 years, sealing FIFTY BILLION containers last year in the U. S. and Overseas.

Continuing research has broadened the scope of the "Flowed-in" process to important new uses in electronics and other mass-production industries, too. Maybe the complete DAREX "package" including machines, sealing compounds and localized service has a place in *your* plant.



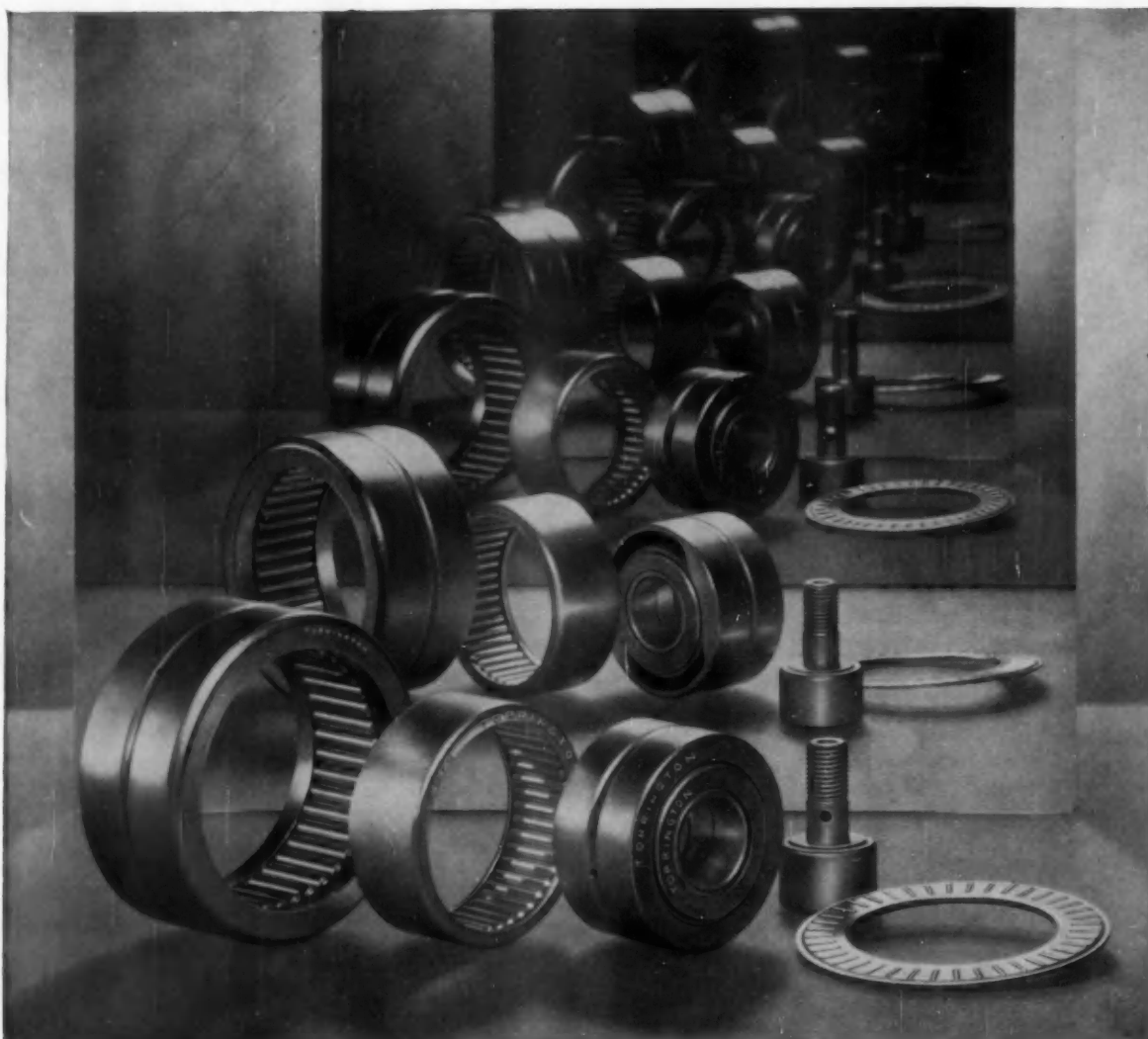
**DAREX** *Flowed-in* **GASKETS**

THE STREAM-LINED SEAL OF MODERN INDUSTRY

  
**DEWEY AND ALMY**  
CHEMICAL COMPANY  
DIVISION OF W. R. GRACE & CO.



Cambridge 40, Massachusetts • Chicago 36, Illinois • San Leandro, California • Montreal 32, Canada



*For new perspectives*  
in **NEEDLE BEARING** *design and performance*

...look to Torrington, pioneer in the development of every type of precision Needle Bearings.

Using carefully selected quality steels, and the most modern manufacturing methods, Torrington has developed a complete range of types and sizes of Needle Bearings for every use. There are special designs for rotation, for oscillation, even thrust applications! There are aircraft types, cam followers, and heavy duty types. Yet their unit cost is low, bringing anti-friction performance with economy.

Precision manufacture and the full complement

of rollers that provides maximum radial capacity in minimum cross section make Torrington Needle Bearings top performers in the most rugged applications.

Little wonder their use has spread to countless applications in every field with outstanding success. Have you considered them for your product? Send for further information today.

**THE TORRINGTON COMPANY**

Torrington, Conn.

• South Bend 21, Ind.

## **TORRINGTON BEARINGS**

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers



**WITH  
COLONIALS**  
the final cost  
is less!



560/  
hour



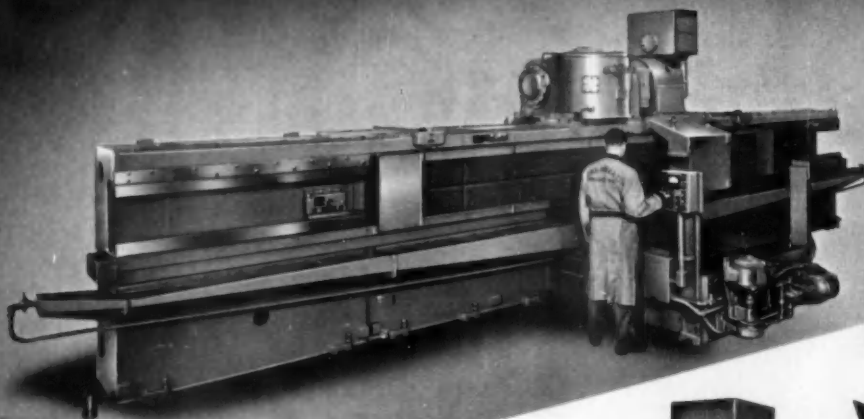
This is a typical UNIFIED BROACHING installation engineered and built by **COLONIAL** with automatic index and unloading to give the lowest cost per piece produced. The machine is a 15-ton, 66-inch stroke **COLONIAL**, covered in our Bulletin RU-54. We'll be happy to send you a copy.

## Broached at 100% Capacity Without Automation

One of those versatile **COLONIAL** installations that can be used so many different ways. This manufacturer needed that many parts an hour of just one part. You might want only 140 parts an hour of four different parts. Can be done just as well in such a set-up. You can find cost saving profit-boosting ideas like this in every issue of **BROACHING NEWS**. If you are not getting it, drop us a line on your company letterhead and we'll gladly put you on the mailing list.

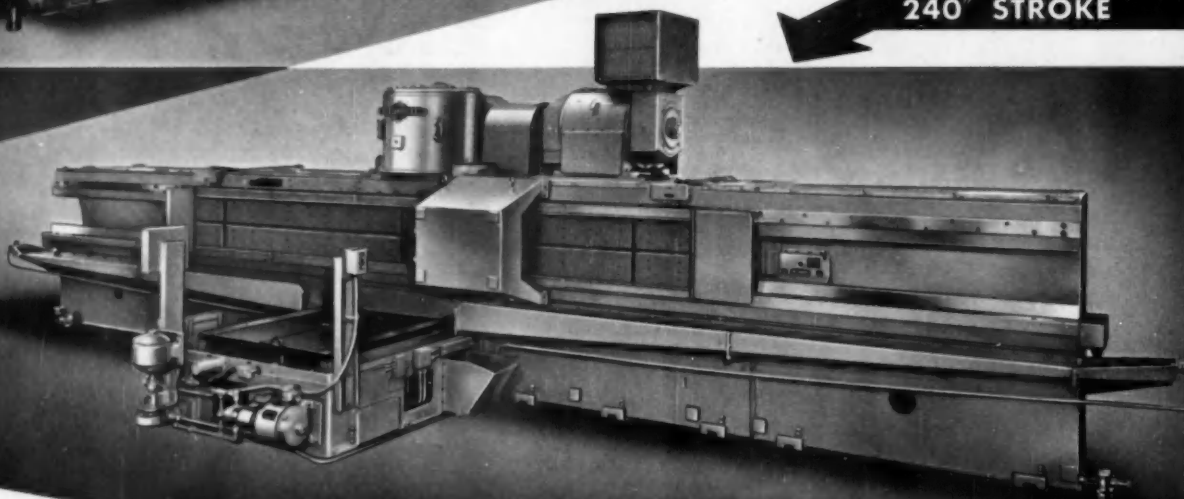


**WITH  
COLONIALS**  
the final cost  
is less!



**180" STROKE**

**240" STROKE**



## Where "Navy-Precision" is Needed **COLONIALS** like these get the Call

Here are two of **COLONIAL'S** line of big ElectroGear drive horizontals, a 180-inch and a 240-inch stroke precision-broaching model being readied for delivery to Navy and Air Force contractors. **COLONIAL** produces both sizes in either 15 or 25 ton capacity. Both are available with ram face widths of 18 or 24 inches and either box type or V-type ways. Phenolic-lined ways available for high accuracy requirements.

They come with trunnion or horizontal shuttle tables; plus a vertical shuttle slide for 2-pass broaching.

Broaching speeds are up to 300 ft. per minute. For more details ask for a copy of Bulletin HM-56.



## PACKARD

(Continued from page 51)

hp. Its bore is 3 9/16 in. stroke 3 3/4 in., and displacement 289 cu in.

New Packard Clippers have up to 15 per cent better acceleration performance than in 1956. This is due chiefly to the use of the super-charger along with the Flightomatic transmission and a new

### Classified Advertisements

**WHOLESALE FUEL (Oil)** E. North Carolina Distributor. 14 service stations. Rent-free property. 5 trucks. Xint location. No competition. Dept. #8325.

**SERVICE STATION:** Norfolk, Va. Retail & wholesale oil & kerosene, auto accessories, services & installs heating & air conditioning equipment. Big profits. Opportunity. Money back less than year. Dept. 8402.

**AUTO PARTS,** Central North Carolina. Wholesale, also machine shop service. Xint city location. Top equipment, includes 2 trucks. Dept. 8445.

**RETAIL & WHOLESALE AUTO. PARTS.** E. SO. CALIF. Well established & equipped. Good income & opportunity for expansion. Owner retiring. Dept. 23923.

**SERVICE STATION,** So. Central Montana. Standard & Atlas products. Xint location. New equipment. Opportunity! Dept. 23955.

**AUTO PARTS,** Portland, Ore. Wholesale & retail. Also, engine rebuilding. \$145,000 gross. Sale price! Inv. & equipment. Rare opportunity! Dept. #23963.

**AUTOMATIC CAR WASH,** So. Calif. New shop central location. Xint profits. All equipment. Illness. Dept. #23970.

**WHOLESALE AUTO PARTS, BODY SUPPLIES,** So. Calif. Near L.A., Xint building top location, A-1 accounts. Complete equipment. Expansion opportunity. Dept. #23982.

**SERVICE STATION,** So. E. Penna. R.E. included. 423 x 200 w/200' Phila. Pike frontage. 6 year old buildings, home. \$100,000 gross! Dept. #42374.

**SERVICE STATION,** E. Penna. Also repairs & accessories. Modern: Living quarters. R.E. Gross \$35,000. Expansion opportunity. Dept. #42383.

**CHAS. FORD & ASSO. INC.,** 6425 Hollywood Blvd., Los Angeles, Calif.

## BUY BONDS



AUTOMOTIVE INDUSTRIES, February 1, 1957

3.31-1 rear axle ratio. The super-charger, a five-pound boost, full pressure type, is driven through a variable ratio pulley.

In pre-production tests, the new sedan equipped with automatic transmission is said to have accelerated from 30 to 60 mph in 6.51 sec, and from a standing start to 60 mph in 10.45 sec.

The Studebaker-Packard Flightomatic transmission, standard on both the sedan and station wagon models, incorporates a positive kickdown gear for constant second gear performance when desired.

Finned brake drums, offered for the first time on the Packard line this year, are said to increase cooling area by 100 per cent.

Standard features include an electric clock, integral arm rests in all four doors, stowaway rear seat center arm rest in the sedan, two inch foam rubber cushions for both front and rear seats, a built-in foot rest for rear seat sedan passengers, dual exhausts, chrome wheel covers, directional signals, back-up lights, full-width safety padded instrument panel, and safety-cone steering wheel.

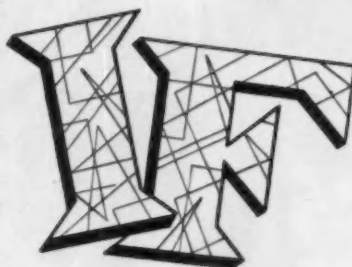
Tinted safety glass, power steering, power windows, power brakes, air conditioning, push button signal-seeking radio, dual rear electrically-operated antennas, rear speaker, safety belts and safety-padded sun visors are optional at extra cost.

## Transfer Machine for Bearing Sets

(Continued from page 55)

The cluster is cut apart into five pieces at Station 19 LH, using arbor-mounted saws with inserted cemented-carbide blades. Depending upon the diameter of the cutter, sawing is done at 325 and 350 sfpm with feed rate of 18.24 in. per minute.

The parts then move to Station 20 where they are unloaded selectively — four caps being unloaded onto an automatic belt conveyor, the rear cap being unloaded onto a different conveyor belt. The parts are ejected through metal chutes and are then delivered by conveyor to succeeding operations and inspection.



*Frequent down-time,  
Materials loss, and  
Rejects*

## HAUNT YOU

*you'll probably find  
the answer to your  
fastener problems in*

## SOUTHERN SCREWS

Southern maintains a stock of more than a Billion screws — all made to exacting standards in our own plant. If your products deserve the permanent assembly that only Quality fasteners can provide — specify Southern all along the line!



Write for Southern's Stock List, or for the Warehouse Guide from the Southern warehouse nearest you. Address Box 1360 - A1, Statesville, North Carolina.

Wood Screws • Stove Bolts • Machine Screws & Nuts • A&B Tapping Screws  
Roll Thread Carriage Bolts • Dowel Screws • Hanger Bolts • Wood & Type U Drive Screws



Warehouses:  
NEW YORK • CHICAGO • DALLAS • LOS ANGELES

# THIS IS FOR MEN...



## ... who are interested in the advantages of of PEARLITIC MALLEABLE CASTINGS

● You can slash production, machining and assembly costs with Albion Pearlitic Malleable Iron Castings. And, here's why:—

- ... Albion's pearlitic malleable irons offer complete freedom of design for greater savings in machining time, the elimination of excess metal and lower finished part cost.
- ... Albion's pearlitic malleable irons afford unusually fine wear resistance with excellent bearing properties. Maximum rigidity and prolonged fatigue life offers outstanding endurance. Yield strength comparable to steel forgings.
- ... Albion's pearlitic malleable irons have a fine, uniform grain structure that machines easily and accurately with exceptional mirror-smooth finishing qualities. Extremely adaptable to localized hardening for specific needs.

Contact the Albion Malleable Iron Company now... they'll be glad to show you how many ways Albion's pearlitic irons can save you time, tools and dollars.

*Remember... Albion's Research and Development Laboratory facilities and competent engineering staff are ready to help you design better products that can be made at lower cost.*

**ALBION  
MALLEABLE  
IRON CO.**  
Albion, Michigan



## Stem Pinions

(Continued from page 69)

initiated, the loading mechanism grasps a forging at the conveyor end, moves rapidly to the headstock, then places the forging between the centers. Once the cycle has been established, one arm reaches in to remove the part from the centers while the other feeds another part between centers. The mechanism then moves rapidly to the opposite end where it unloads the finished part, picks up an unfinished part, and returns to the "wait" station over the tailstock.

The first machine rough-turns the large bearing diameter, the taper, small bearing diameter, and the splined and thread end. This operation requires four tools — all massive triangular-shaped solid carbide with chip breakers.

The second machine rough-turns the face angles, and semi-finish-turns the thread diameter. This machine has three triangular solid carbide tools with chip breakers.

The third machine finish-turns the areas previously rough-turned in the first machine, employing four triangular solid carbide tools with chip breakers.

The fourth machine finish-turns the head, back face, taper, and threaded end chamfer. It is provided with three solid carbide triangular tools and two, 1/2 in. square throw-away wafers.

The fifth machine is used primarily for chamfering all over and facing of the threaded end. It has a cluster of seven tools — all throw-away wafer type.

Each of the lathes is provided with a built-in chip conveyor, arranged to dump chips and cutting fluid onto an apron type conveyor at the exit end.

Clamping of the work on centers is handled simply and ingeniously. The tailstock center is brought in under hydraulic pressure while the headstock center comes in under air pressure. Driving is done by means of seven serrated carbide buttons at the headstock end, forced into the head under pressure.

The forging material is a high manganese-molybdenum steel, machined in the annealed state. One of the troublesome problems associated with this material is the development of a characteristic stringy chip.

Since this description was prepared some time before official process standards were established, the data given at this time are fragmentary and doubtless subject to revision. At the moment it appears that the line

(Turn to page 116, please)



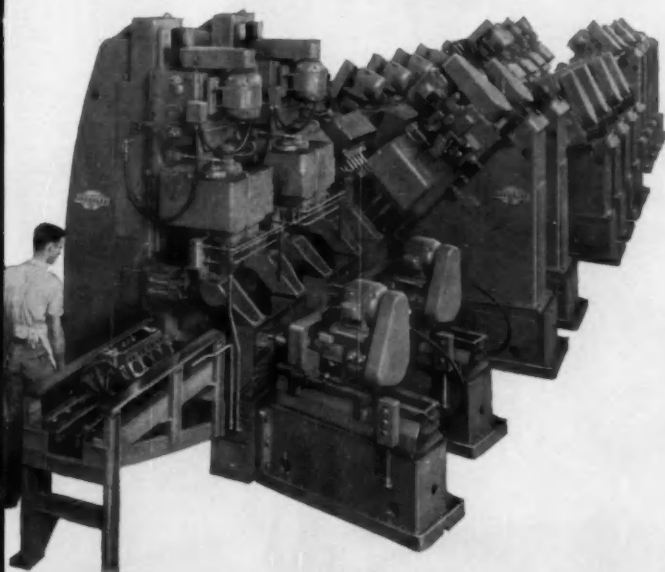


PRODUCTION MACHINERY

**GREENLEE**



## NOW... BIGGER TO SERVE YOU BETTER



This 17-Station Greenlee Transfer Machine, the first in a line of three . . . carries 152 tools. It automatically drills, countersinks, cleans and gauges holes in V-8 cylinder blocks. Take advantage of Greenlee's specialized assistance in planning for automatic production. Write or wire today for a consultation.

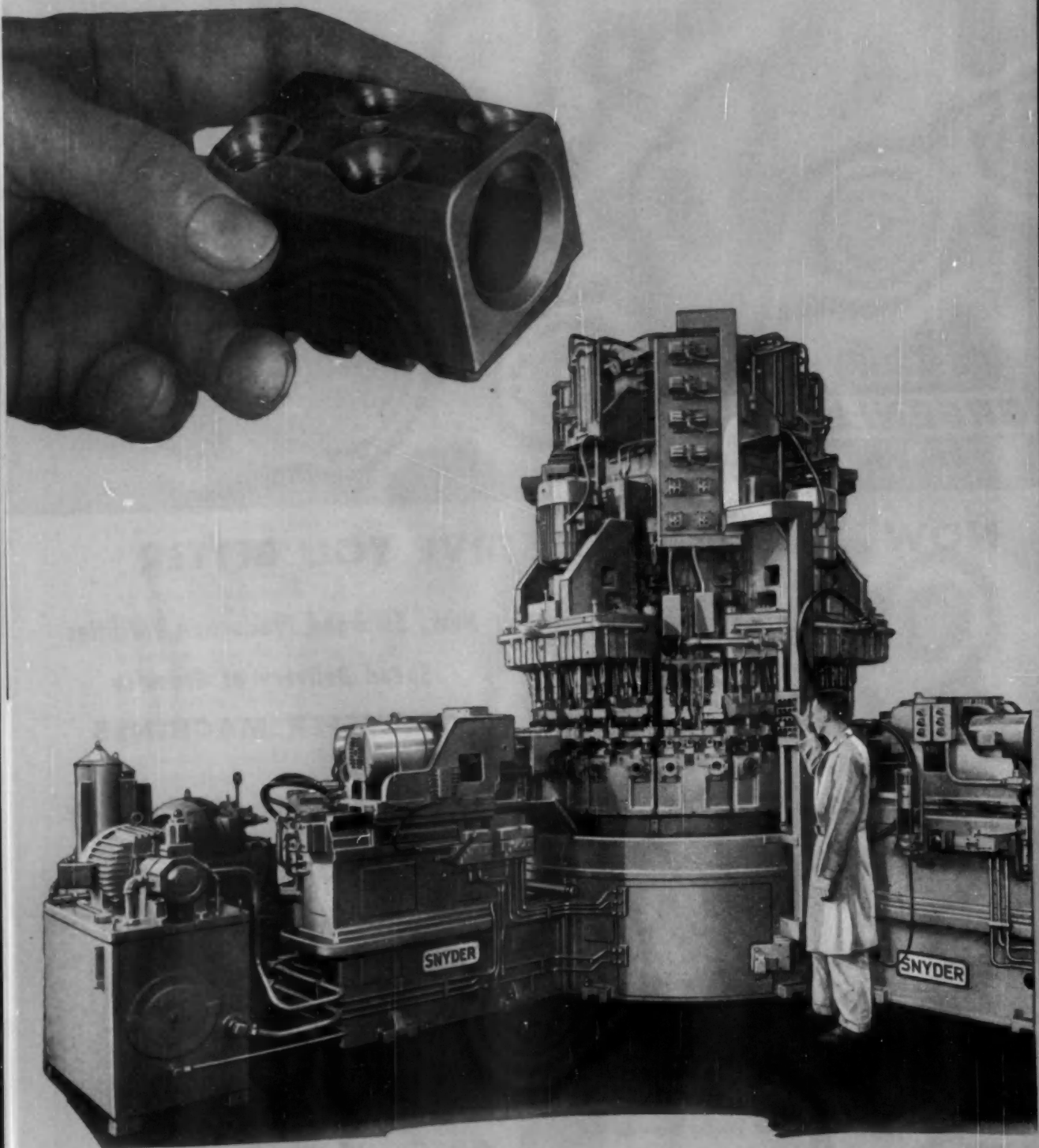
### *New, Enlarged Production Facilities* *Speed Delivery of Greenlee* **TRANSFER MACHINES**

Pictured is one of four Greenlee assembly floors. This newly constructed, block-long building covers almost two acres of ground . . . provides a well-lighted, roomy area for erecting and testing Greenlee Transfer Machines similar to the ones illustrated.



**GREENLEE BROS. & CO.**  
1752 Mason Avenue  
Rockford, Illinois

# **Simplified Automation in Successfully Applied in New**



# Machining Small Parts is Snyder Center Column Machine

The principle of automation is inherent in the design of this machine which performs, in its continuous 16-station cycle, 25 operations equalling the performance of two or three ordinary machines. The workpiece is a small automotive steering gear ball nut  $2\frac{1}{2}" \times 1\frac{1}{8}" \times 1\frac{1}{8}"$ . Production is 331 pieces per hour.

Three workpieces are loaded and automatically clamped in each of the 16 fixtures on the 96" index table. A unique feature of the machine is its special heavy-duty cast iron center column 108" high and 48" in diameter. This massive column is necessary to withstand the high vertical thrust loads imposed by six heads

mounting 9 spindles each which drill, flat bottom drill and radius chamfer four recirculating ball holes and tap drill and chamfer one hole in the same part face.

The table is also designed to withstand high horizontal thrust loads for core drilling, chamfering and reaming the threaded shaft hole which requires three spindles for each of the seven Snyder heavy-duty way type units.

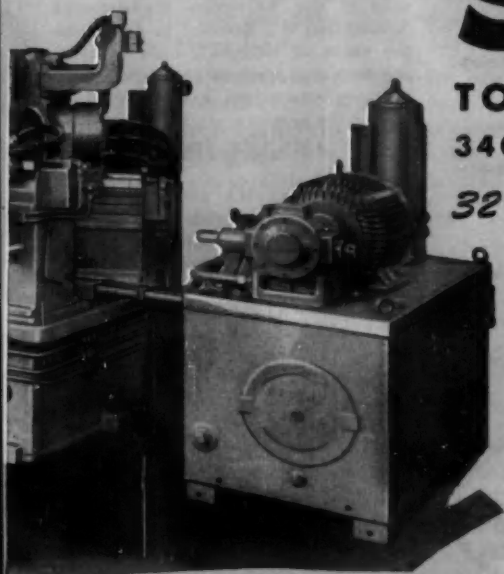
The machine, one of the largest of its type, weighs 50,000 lbs., requires 288" x 312" floor space and stands 156" high overall.

If you have an automation problem in machining small parts, this type of Snyder machine may be the right answer.

# SNYDER

**TOOL & ENGINEERING COMPANY**  
3400 E. LAFAYETTE • DETROIT 7, MICHIGAN

*32 Years of Special Machine Tools with Automation*



# FINEST

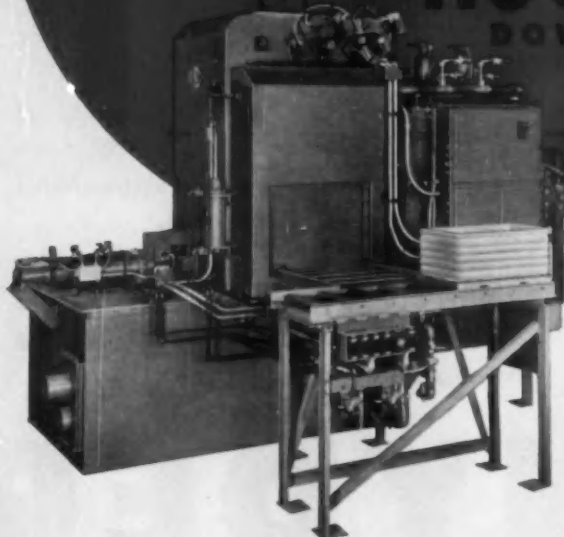
## AUTOMATED BATCH-TYPE

### CONTROLLED ATMOSPHERE

#### FURNACE—THE

# HC-800

DOWmatia



All the proven advantages of DOW'S top quality controlled atmosphere, furnaces with built-in atmosphere generators . . . PLUS time saving automation in one compact, efficient package.

This new furnace pre-conditions, loads and unloads the work chamber, quenches the charge and discharges the finished work without operator handling.

No time loss, no guessing, no human error . . . every load identically processed and handled.

*Write for detailed literature.*

# DOW FURNACE COMPANY

12045 Woodbine Ave., Detroit 28, Mich.  
Phone: KEnwood 2-9100

*First* WITH  
MECHANIZED, BATCH-  
TYPE, CONTROLLED  
ATMOSPHERE FURNACES

## Stem Pinions

*(Continued from page 112)*

will produce at the rate of about 200 pieces per hour (maximum) or a net output of around 150 pieces an hour.

Spindle speeds vary with the operation, from about 1300 rpm for roughing to 1750 rpm for finishing. Surface cutting speeds naturally will vary in accordance with the diameter of a particular section. Maximum cutting speed appears to be 961 sfpm for finishing cuts, ranging downward to 890 sfpm. Feed rate is of the order of 0.014 in. per revolution.

Needless to say, the economy of this setup stems not only from the fully automatic cycle of events through the battery of six machines but also from the high inherent productivity of the basic LoSwing lathe. Tool life, which will govern the maximum utilization of this line, still remains to be determined. However, experience to date indicates a life of about 200 pieces per edge.

## AUTOMATION News Report

*(Continued from page 68)*

an eight-channel pressure recorder and seven electronic thermometers. Thermocouples inside the chamber can be connected to show temperatures at 120 points on test pieces.

All instrumentation, including program and control, was designed and installed by Fischer and Porter Co.

### A.M.A. CONFERENCE

The third annual electronic conference of the American Management Association will attempt to dramatize the value of electronic data processing as a management tool. Over 1000 business executives are expected to attend the sessions, which will be held in New York City, from Feb. 25 to 27.

Highlight of the proceedings will be a live closed circuit telecast from four different company locations showing machines at work on data processing problems. From the scene of each telecast, company representatives will furnish a running commentary on the action of the data processing equipment.

Participating in the telecasts will be Consolidated Edison Co. of New York, Inc., which will demonstrate customer accounting on the Remington Rand Univac I, and payroll and general accounting on the I.B.M. 705; Chambers Works of E. I. du Pont de Nemours & Co., Inc., which will show inventory control and control of main-





# NEW RELIANCE BRAKEMOTOR

These new motors are specifically designed for tough operating conditions. Corrosion-proof cast-iron housings and sealed joints make this motor impregnable to foreign material.

Braking torque ratings from 3 ft. lbs. thru 345 ft. lbs. Fail-safe mechanism immediately applies brake in case of power failure. One piece molded brake linings provide fast, smooth stops and unmatched holding power for heavy loads.

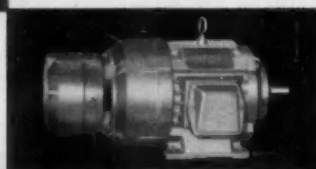
Simple brake has only six parts and requires no control wiring or auxiliary electrical equipment. Compact construction requires a minimum of space. Wearing parts are easily accessible for fast maintenance.

For further information write for bulletin B-2503.

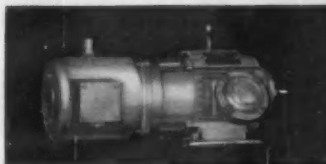
**See Your RELIANCE  
Sales Engineer TODAY**

**RELIANCE ELECTRIC AND  
ENGINEERING CO.**

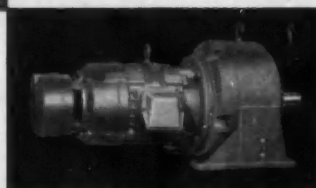
Dept. 52A, Cleveland 17, Ohio • Canadian Division: Welland, Ontario  
Sales Offices and Distributors in Principal Cities



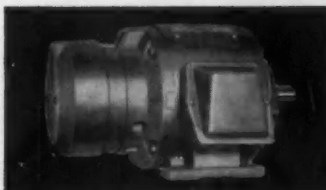
Totally-Enclosed, Corrosion-Proof



Explosion-Proof—Cl. I, Gr. D and  
Cl. II, Grs. E, F & G



Corrosion-Proof Gearmotor



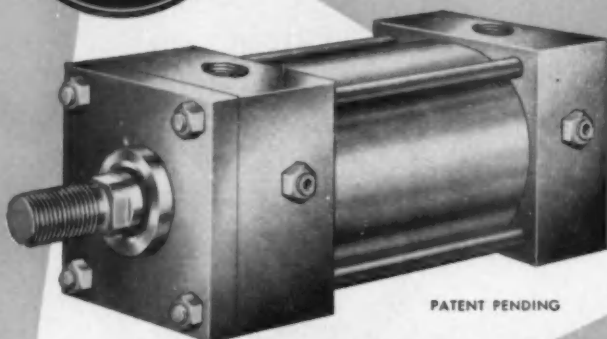
Protected



# FOR AUTOMATION



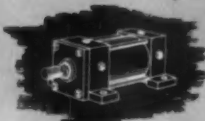
# CYLINDERS



PATENT PENDING

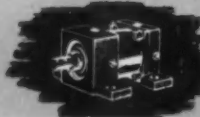
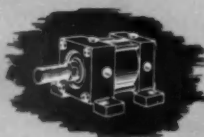
## top performance—longest life

All S-P cylinders are engineered throughout for high speed, efficient operation. Piston rods are heat treated and hard chrome plated to resist scoring. Bronze cartridges with extra long bearing surfaces are easily removable for quick servicing of rod seals and wipers. End plates are rolled steel. All S-P cylinders are built to JIC standards.



**S-P STANDARD AIR CYLINDERS** have brass tubes to eliminate corrosion. Cushions float on O-rings for maximum cushioning. Eleven bore sizes, 1½" — 14". 21 mounting types. Readily modified for oil or water. Send for Catalog No. 110.

**S-P HEAVY DUTY AIR CYLINDERS** for automation and other severe applications. Double porting for extreme high speeds. Heavy wall seamless steel tube. Nine bore sizes, 1½" — 8". Five mounting types. Approved and used by two major automobile manufacturers. Send for Catalog No. 109-A.



**S-P HIGH PRESSURE HYDRAULIC CYLINDERS** have seamless steel tube. Special locking mechanism eliminates tie rods. Designed for 2,000 psi. Eleven models in 11 sizes. Send for Catalog No. 104.

Step up production with S-P cylinders. Representatives in principal cities. Prompt deliveries. Order catalog by number shown above. The S-P Manufacturing Corporation, 30201 Aurora Rd., Solon, Ohio. *In greater Cleveland.*

**Specify S-P**



**THE S-P MANUFACTURING CORP.**  
 SOLON, OHIO • IN GREATER CLEVELAND  
 ESTABLISHED 1916 A BASSETT COMPANY

NON-ROTATING AIR AND HYDRAULIC CYLINDERS • ROTATING AIR AND HYDRAULIC CYLINDERS  
 POWER CHUCKS • COLLET AND DRILL PRESS CHUCKS • AIR PISTONS, VALVES, ACCESSORIES

tenance and miscellaneous stores on an I.B.M. Ramic; Sears Roebuck and Co., payroll accounting and sales, and inventory budgeting on the Burroughs Datatron; Ford Div. of Ford Motor Co., production control scheduling, supplier authorizations, and shipping instructions on the Remington Rand Univac computer.

## AUTOMATIC ROLLING MILL

The steel industry's first completely automatic card-programmed rolling mill will be placed in operation late this year at Jones & Laughlin Steel Corp.'s Aliquippa Works. The control system was developed by Westinghouse Electric Corp.'s Motor and Control Div. and it is known as Prodac, because of its general applicability as a programmed digital automatic control for system drives.

Once the system is operable, an operator will be able to initiate a detailed rolling schedule simply by pressing a button. The control system will have been given the schedule for any set of rolling operations in the form of pre-punched IBM cards. These cards can be prepared for practically every slab and strip size and grade of steel, so that proper drafts and speeds will produce a highly uniform product at maximum production rates. Each card includes all the requirements of a given schedule: mill screw-down opening, edger adjustment, opening mill speed, and edger speed.

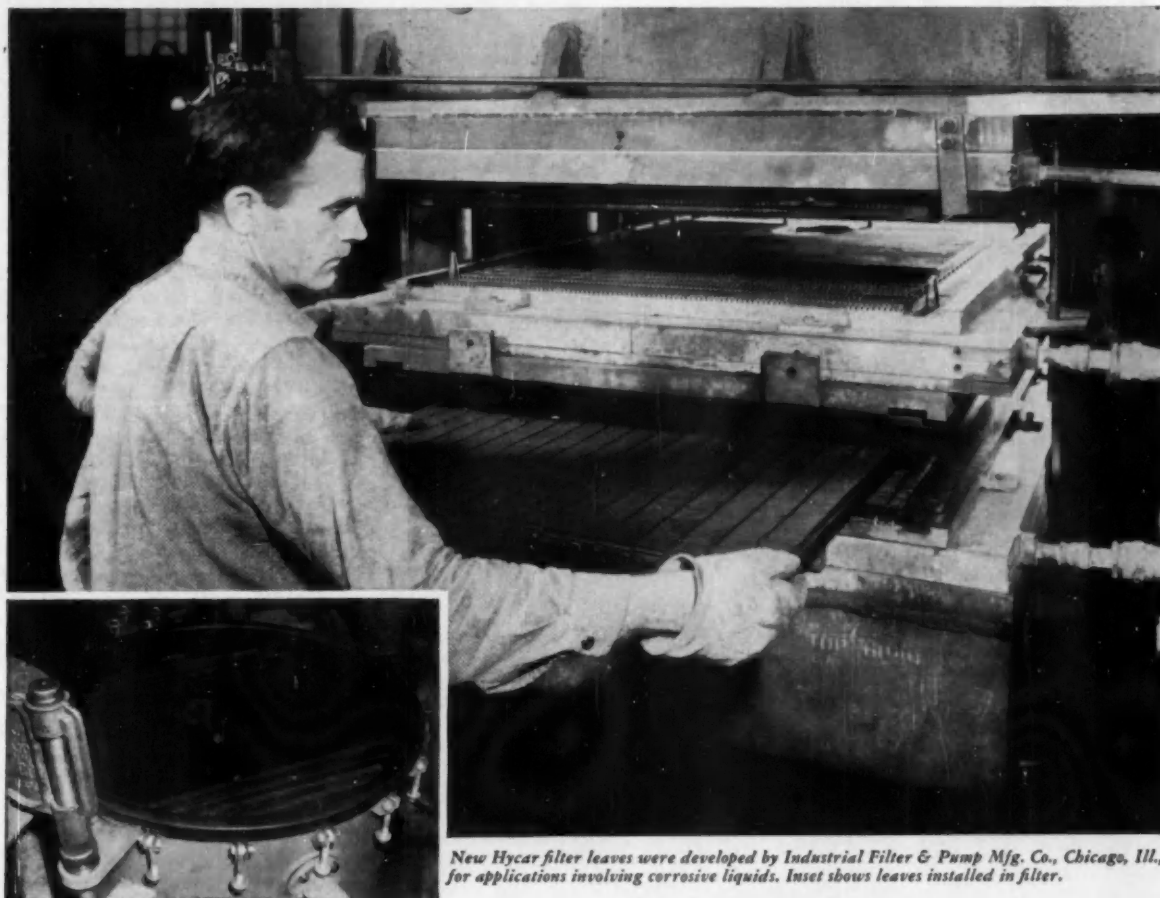
A stack of cards for all schedules is placed in the IBM reader, which reads them off one at a time, transferring all the information to a memory storage element. When the first pass is initiated, the control equipment acts through magnetic amplifier output units to preset roll openings and speeds. After one pass, reversing is accomplished by sensing devices that read the position of the slab and reverse the rolls after a brief slow-down. After every pass roll openings and mill speeds are readjusted according to the schedule filed in the memory storage element. After the final pass, an indicator light signals the operator at the shear crop that the strip is ready to enter the finishing mill. The same process is repeated with the next card in the IBM reader, and so on.

When completed, the new roughing mill will feed a six-stand continuous hot strip mill. Main horizontal rolls of the mill are 42 inches in diam and 44 in. wide. Each edger roll is 24 inches in diam.

(Turn to page 122, please)

Another new development using

## B.F. Goodrich Chemical raw materials



New Hycar filter leaves were developed by Industrial Filter & Pump Mfg. Co., Chicago, Ill., for applications involving corrosive liquids. Inset shows leaves installed in filter.

## HYCAR RUBBER TAKES A HOT ACID BATH IN INDUSTRIAL FILTER

**F**ILTERING hot corrosive acids usually means high maintenance and replacement costs. But this filtration equipment is able to stand up to the toughest jobs by using Hycar nitrile rubber as a standard material for molded filter leaf construction.

The Hycar leaves support filtering media such as nylon, cotton, paper, etc., and permit run-off of the filtrate. Hycar provides superior resistance to a wide variety of solvents and chemicals as well as heat—plus excellent aging and abrasion properties. Thus the filter is suitable for processing

corrosive chemicals, filtering sugar liquors and other food products, and recovering materials from waste water.

The exceptional qualities of Hycar rubber have led to this kind of product improvement in many industries. It is easily molded and extruded and retains high dimensional stability after shaping. And it can be compounded to provide the right hardness and physical characteristics.

There's probably a need in your own operations for the remarkable

properties of Hycar rubber. For complete information, please write Dept. EA-1, B.F. Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, O. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

**Hycar**  
Reg. U.S. Pat. Off.  
*American Rubber*

B.F. Goodrich Chemical Company  
a division of The B.F. Goodrich Company



GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

## Annual Meeting of the SAE

(Continued from page 96)

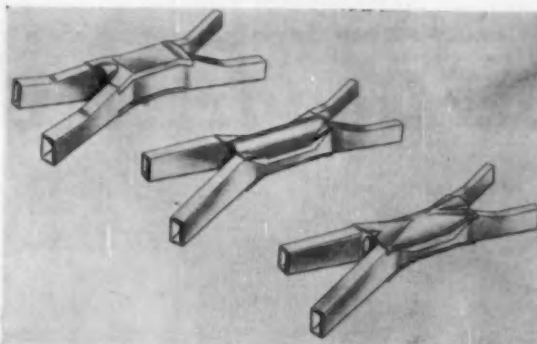
### The Cadillac Frame

By J. R. Parker  
A. O. Smith Corp.

SEVERAL design features were discovered during the development tests made for Cadillac. Two of these may be worthy of reporting. The contour of the tubular center section,

Fig. 1 — Evolution of frame tunnel contours

particularly in the region in which it



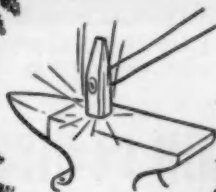
branches out to merge with the extending legs, was found to be a very important factor in the rigidity of the entire frame. In one of the tests, an increase in torsional stiffness of the complete frame of more than 20 per cent was achieved through a change in contour of the top tunnel member without any increase in section size, material thickness, or weight. Bulkheads or shear plates at the ends of the tunnel section were also found to be very desirable in terms of the increase in torsional efficiency they produce. In the 1957 Cadillac frame, a bulkhead was applied at the front end of the tunnel, and a short crossmember just rearward of the tunnel to achieve the same effect.

Both the external contour and the bulkhead are effective because of the action of this portion of the frame in resisting overall torsional loads. When torsional loading is applied to the frame, one front beam and the diagonal rear beam are loaded downwardly while the opposite members are loaded upwardly. This results in a combination of cantilever bending and torsion in the legs themselves and a condition of almost true torsion at the center of the tubular section. The stresses in the extending beams must be transmitted into the tubular center section with a minimum of buckling or other secondary distortions in order to provide optimum rigidity. Fig. 1 shows three of the tunnel shapes studied. The first proved structurally effective but required too much space in the rear passenger compartment. The second shape was satisfactory for space but its formation resulted in high deflections. The third shape is the one which was finally released for production since it proved optimum both from the standpoint of space required and performance.

The distribution of metal within the center section was also studied as shown in Fig. 2. Since the extreme fiber material is the most effective, the third section proved best. This construction is simple and straightforward from a manufacturing stand-

# WAUSAU

Alloy No. 2



### Valve Seat Inserts that stay tight in aluminum



Developed especially for aluminum alloy engines Wausau Alloy No. 2 Valve Seat Inserts have the same expansion characteristics as many popular aluminum alloys. Result: a tight seat that won't work loose. These inserts have high impact resistance which is work-hardened in use. They are corrosion resistant and extremely stable under heat, resisting burning and distortion under severest operating conditions. Alloy No. 2 inserts are available in a wide range of types and sizes to fit your specifications. Call or write Wausau Motor Parts Company, 2200 Harrison Street, Wausau, Wisconsin.





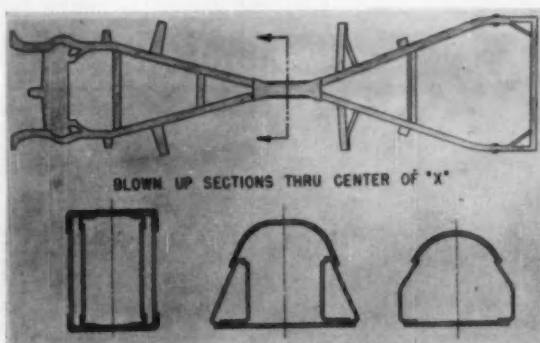


Fig. 2 — Evolution of frame tunnel cross sections

point and provides for a minimum tunnel size in the body floor. It requires an increase in tunnel size of not more than  $\frac{1}{2}$  in. radially beyond that which would be needed for the propeller shaft clearance alone if the frame structure were located elsewhere. Space for the frame in the front compartment has not proven to be a particularly serious problem. The front floor is normally higher than the rear floor by several inches because of the difference in seating requirements and headroom for the front seat passengers and because of clearance needed for the transmission. Furthermore, the high degree of rigidity in the center of the frame has allowed for a frame depth reduction in the front seat area without a loss in efficiency of the overall unit.

In the case of Cadillac, the tubular center "X" frame design was competing with their 1956 model which had the highest structural efficiency of any passenger car frame in the industry, in terms of stiffness per pound of weight adjusted for wheelbase. The 1957 frame is actually slightly heavier than the 1956 ( $4\frac{1}{2}$  per cent) but it is also considerably more rigid (41 per cent bending,  $7\frac{1}{2}$  per cent torsion). If the rigidity had been maintained at the 1956 level, the frame could have been more than 10 per cent lighter than the comparable 1956 model. Structural performance is considered to have been improved correspondingly.

#### Canadian Automobile Industry Marks 1956 as Top Sales Year

Canada's automobile industry had its best sales year in 1956, when almost 500,000 cars and trucks with a retail value of \$1.4 million were sold. Total passenger car registrations in Canada at end of 1956 amounted to 3.2 million, and commercial vehicle registration was one million units.

Total 1956 production was 472,703 cars and trucks, just under the all-time record of 481,000 units estab-

lished in 1953. Of the total, 374,163

were passenger cars, with 98,540 trucks.

General Motors of Canada produced 148,179 units, despite a strike in the early part of 1956; Ford of Canada, 119,599; Chrysler Corp. of Canada, 92,119; American Motors, 5584; and Studebaker-Packard, 8682.

By individual makes, Chevrolet led the field with 70,236 units; Ford, 69,766; Pontiac, 46,863; Dodge, 45,133; Plymouth, 39,366; Meteor (Ford), 34,331; Buick, 19,799; Oldsmobile, 11,281; Monarch (Ford), 7998; Mercury, 7504; Chrysler, 6041; and DeSoto, 1579.

# WAUSAU

WF-3-0



## Sintered Metal Piston Rings

WF-3-0 is a uniquely different sintered iron alloyed in the powder form so as to permit extremely accurate analysis control when the metal is produced. As a result, rings made from WF-3-0 have greater uniformity and stability, higher tensile strength and high modulus of elasticity. Ring breakage is eliminated, ring life increased and performance greatly improved. In addition, simplified production techniques have resulted in a better ring at lower cost. WF-3-0 rings are especially effective in small bore engines, automatic transmissions, power steering units and similar applications. Call or write Wausau Motor Parts Company 2200 Harrison Street, Wausau, Wis.





Special B Fasteners—Sample brochure sent upon request

## SEE ANY NUMBER YOU CAN USE?

® specials like these were created to increase the life and reputation of many products. They cut costs... reduce assembly time... make better designs a cinch.

They or other ® specials can do the same for you.

Use ®'s to improve YOUR product... create NEW designs around them. Call Buffalo Bolt for quotes and service.

**BUFFALO BOLT COMPANY**  
Division of Buffalo-Eclipse Corporation  
NORTH TONAWANDA, N. Y.

### • 3 convenient service centers

**WESTERN OFFICE**  
Chicago  
Harrison 7-2179

**EASTERN OFFICE**  
New York City  
REctor 2-1888

**CENTRAL OFFICE**  
North Tonawanda  
JACKson 2400 (Buffalo)

Many **GOOD** products  
can be made **BETTER**  
...with



**SPECIAL  
FASTENERS**

## AUTOMATION News Report

(Continued from page 116)

### AUTOMATION BIBLIOGRAPHY

Bulletin 1198, issued by the U. S. Dept. of Labor, carries the impressive title: "Automatic Technology and Its Implications." The publication lists 359 references, including articles, books, reports, speeches, pamphlets, and other readily available material, along with a brief description of each item. Most of the material listed was originally published in 1955 and 1956 and is primarily concerned with the social and economic aspects of automation. Technical articles of interest only to engineers have been deliberately omitted.

## News of the MACHINERY INDUSTRIES

(Continued from page 78)

size in each bore. A major feature is that bore size can be adjusted to any tolerance within the range by a simple adjustment on the console. Thus it is possible to specify bores suited to the selection of pistons for a given engine. In effect, this will make it possible to consume all of the pistons machined in regular production regardless of variations. The range in bore tolerances can be as much as 0.004 in.

### New Home Coming

To be announced soon is a new concept in honing equipment designed for small lot production while at the same time providing any degree of automaticity that may be economical. To be known as the 150 Hydrohoner, it is a single-spindle, horizontal type honing machine, featuring a one-piece base. Designed for extreme flexibility, it will be available in a standard form to which may be added package equipment to afford any desired form of automatic sizing and automatic loading and unloading. A major feature is the fact that initial investment in a standard machine will be low since the package equipment can be added at any time later.

**AUTOMOTIVE INDUSTRIES  
KEEPS YOU INFORMED**

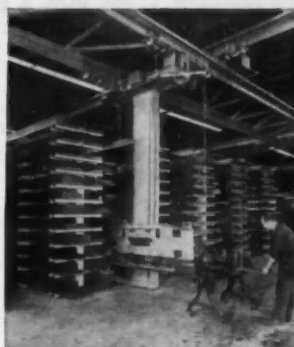
Neat, convenient and efficient steel bar storage stacked mechanically by the American MonoRail Stacker in narrow aisles



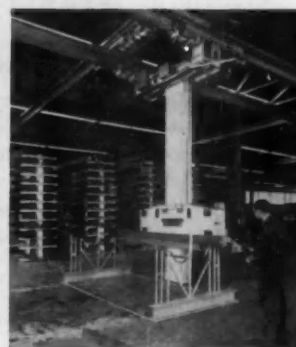
## HOW'S THIS FOR STEEL STORAGE!

American MonoRail engineers, working with Hawkridge Brothers Company, designed this system for storing bars, rods and other long steel shapes.

Note the extremely narrow aisles and maximum height of racks. Bars and rods, 20-22 feet long, are placed in pans 18 feet long. The American MonoRail Stacker transfers these pans to either side of an aisle for storage.



*MonoRail Stacker forks support bar in saw. Saw with extension rolls to any convenient spot in the warehouse.*



*American MonoRail Stacker lowers a banded bundle of bars over prong which ingeniously splits bands, lets bars roll into trough for pick-up in a tray.*

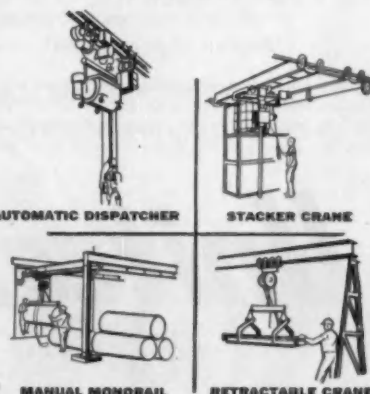
Photos: Courtesy of Hawkridge Brothers Company, Waterbury, Conn.

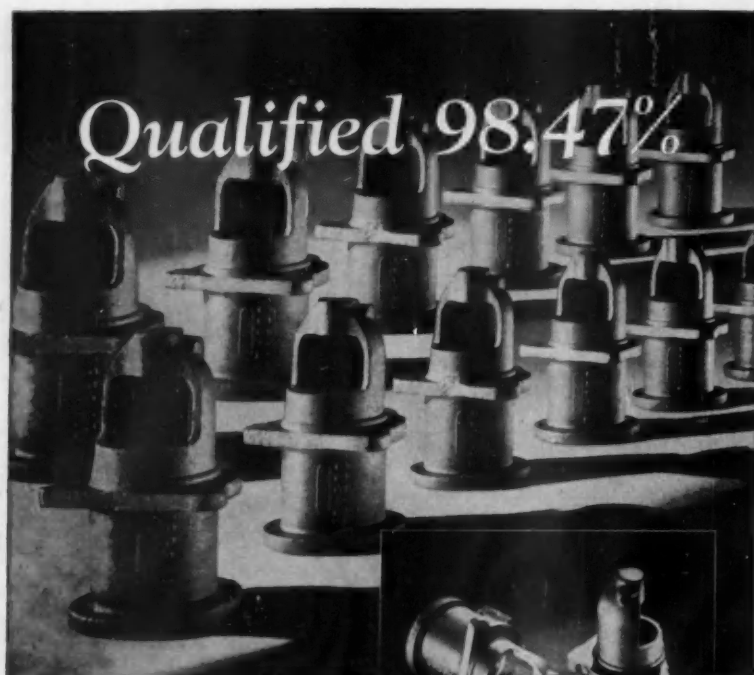
Member of Materials Handling Institute - MonoRail Association



AMERICAN  
**MONORAIL**  
COMPANY

13147 ATHENS AVENUE, CLEVELAND 7, OHIO (IN CANADA—CANADIAN MONORAIL CO., LTD., GALT, ONT.)





## .. another job done better with **UNITCASTINGS!**

Faced with a problem of economically producing a starter housing that would take more than normal abuse, Unitcast engineers successfully provided the answer with *steel* castings. Previous to the use of Unitcastings, replacement costs were excessive and the need of a tougher material was imperative. Cost was also an important requisite, and by delivering *consistent* quality in conjunction with a tougher material—scrap and lost time has been held at a minimum. To date, more than 33,000 units have qualified with a higher basic cost being offset by practically no replacement and most important—a lower *finished* cost!

Take another look at the *finished* cost of your parts inventory—perhaps you can do better with Unitcastings! Consult a Unitcast engineer, soon!

UNITCAST CORPORATION, Toledo 9, Ohio

In Canada: CANADIAN-UNITCAST STEEL, LTD., Sherbrooke, Quebec

# Unitcast



**QUALITY  
STEEL  
CASTINGS**



There are 54.3 million passenger cars and 10.975 million trucks and buses or a grand total of 65.275 million motor vehicles, in use in America today.

All the cars in the U.S. would form a continuous line more than seven times around the earth at the equator.

A total of 66.875 million motor vehicles, with a wholesale value of \$95.8 billion, have been produced and sold in the U. S. during the 10 years since 1947.

Today, Russia is graduating almost three times as many engineers as the U. S.

Tires of a giant new U. S. airliner each contain sufficient nylon to manufacture 60,000 pairs of ladies hose.

During 1955, 65 per cent of the 3,421,911 people traveling between the U. S. and foreign countries traveled by air.

A brand new version of a giant commercial passenger plane weighs more than twice as much as its original model built 17 years ago; flies about twice as far; carries three times as much payload; and its cruising speed is 125 mph faster.

A modern jet engine, widely used in Air Force and Navy planes, can consume enough fuel in 10 minutes to operate a new 1957 model automobile for 12,500 miles, or to heat a five-room house for a full winter.

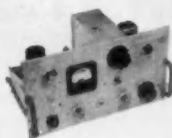
In 1945, the scheduled airlines of the world flew approximately five billion passenger miles. In 1955, they flew 70 million passengers (slightly more than the combined populations of the British Isles and Canada) more than 38.5 billion passenger miles.



## TECHNIQUES and DEVELOPMENTS in oscillographic recording

**PHASE SENSITIVE DEMODULATOR PRE-AMPLIFIER PROVIDES A DC VOLTAGE PROPORTIONAL TO AN INPHASE COMPONENT OF AN AC VOLTAGE WITH RESPECT TO A REFERENCE.**

**T**HE measurement of the amplitude of an AC voltage component is often necessary in performance studies of servo systems or of suppressed carrier signals over the carrier frequency range from 60 to 10,000 cps. In such cases the demodulator responds to inphase signals and rejects quadrature signals.



A circuit with these characteristics for use in an oscillographic recording system can be seen in the Model 150-1200 Servo Monitor (Demodulator) Preamplifier. It was developed by Sanborn as one of twelve interchangeable, plug-in front ends for "150" Series equipment, to be used with the appropriate Driver Amplifier-Power unit in any channel of a "150" system. Elements comprising the circuit from input to output, include: compensated stepped attenuator and cathode follower input circuit, phase inverter, push-pull mixer and demodulator stages, differential DC output amplifier and low pass filter. In addition, the chassis contains a VTVM to facilitate accurate adjustment of the reference voltage, and an overload indicator which lights a warning lamp when excessive quadrature voltages exist.

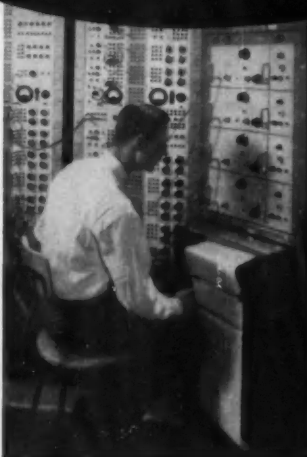
Adaptability to a fairly wide variety of applications is accomplished through broad input voltage, reference voltage and frequency ranges. In order, these are 50 mv to 50 v (for full scale 5 cm deflection), 10 v to 125 v; 60 cps to 10kc. Rise time with low frequency plug-in demodulation filter is 0.1 seconds; with high frequency filter, 0.01 seconds. Quadrature rejection is better than 100:1; for carrier frequencies up to 5000 cycles.

Two representative uses of the Servo Monitor Preamplifier are in the design and adjustment of servo systems, and with instruments used in the design, development or adjustment of other apparatus. The first is illustrated by use of the Preamplifier and associated equipment in the recording of the output shaft amplitude and driving frequency of an AC positional servo; the second by recordings made with a similar setup of the difference between output signals from a gyroscopically-controlled stabilizing device and the "pitch" and "roll" signals generated by a "Scorsby Table" used for testing the device under dynamic conditions.

For a detailed discussion of the principles and design considerations involved in the Servo Monitor Preamplifier, refer to the February, 1955 issue of the Sanborn RIGHT ANGLE, for Dr. Arthur Miller's article on "Measurements with the Servo Monitor Preamplifier."

Technical literature and engineering assistance on specific problems are always available from our engineering department.

FROM  
**SANBORN**



**BASIC  
FACTORS  
IN SELECTING  
OSCILLOGRAPHIC  
RECORDING  
EQUIPMENT**

**W**HEN considering any oscillographic system or equipment for your application, three useful "yardsticks" to apply are (1) the recording method, (2) equipment adaptability, and (3) variety of equipment available. Here are the answers to the three, as they apply to Sanborn systems. In the record, rectangular coordinates accurately correlate multiple traces, simplify interpretation and eliminate errors. Permanent traces, produced by a hot ribbon stylus without ink, provide sharp peaks and notches, and clearly reveal all signal changes. One percent linearity results from current feedback driver amplifiers and high torque galvanometers of new design; maximum error is  $\frac{1}{4}$  mm in middle 4 cm of chart,  $\frac{1}{2}$  mm across entire chart. From the standpoints of "adaptability" and "variety", Sanborn "150" equipment offers the versatility of 13 different plug-in front ends for any basic system . . . the choice of one- to eight-channel systems . . . the variety of nine chart speeds, timing and coding controls, console or individual unit packaging . . . availability of equipment as either complete systems or individual amplifier or recorder units.



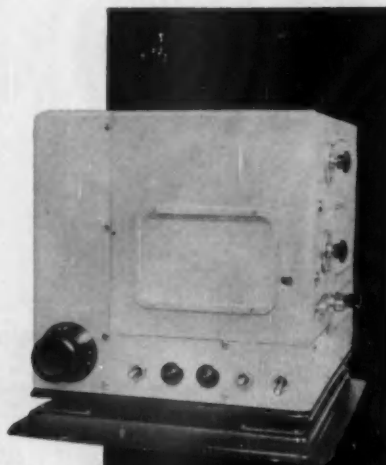
The purpose of the foregoing information is to better acquaint industry with typical oscillographic recording problems and their answers, design considerations in Sanborn equipment, and basic data on what Sanborn makes and how it is being used.

**SANBORN COMPANY**

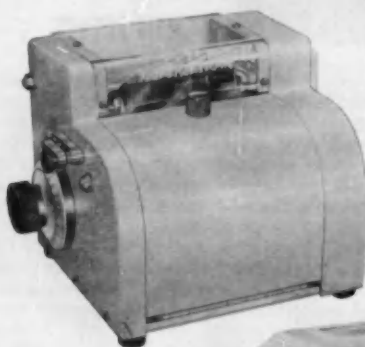
INDUSTRIAL DIVISION  
135 WYMAN STREET, WALTHAM 24, MASS.

# High-Speed Recording

with  
instantaneous  
readout



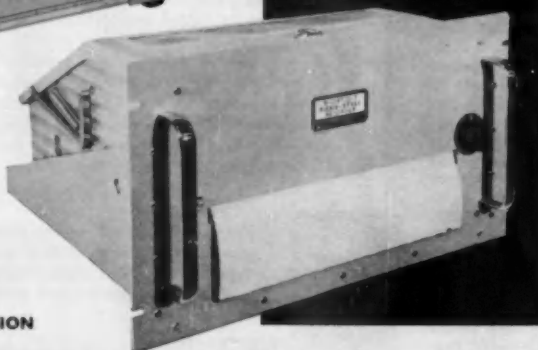
- **FAST**  
100 usec rise time
- **ACCURATE**  
 $\pm 0.2\%$  [5-inch tape]  
 $\pm 0.1\%$  [12-inch tape]
- **DIRECT READING**  
No processing necessary



MODEL R1021-D [5-INCH]

MODEL R1021-1B [5-INCH]

MODEL R-1047-10 [12-INCH]



WRITE FOR  
COMPLETE INFORMATION



**RADIATION Inc.** Melbourne, Fla.  
Orlando, Fla.  
Electronics • Avionics • Instrumentation

PERSONNEL INQUIRIES INVITED

## MEN in the NEWS

(Continued from page 40)



*Bendix Aviation Corp. — Louis Polk is now vice - president, director, group executive, and member of the administration committee.*

Robert Bosch Corp. — Foster N. Perry was elected chairman of the board.

Motorola Inc.—Paul V. Galvin was elected chairman of the board, and Robert W. Galvin succeeds him as president.

Clark Equipment Co. — Claud A. Fenn has been named coordinator of manufacturing operations.

Electro-Snap Switch & Mfg Co.—Harold Ames, Jr., was named president.

Republic Gear Co.—Steven S. Gordon is now assistant general manager.

Thompson Products, Inc., Replacement Div.—A. Kenneth Hannum has been made chief engineer.

General Electric Co. — John B. Montgomery was made general manager of the Production Engine Dept.

Borg-Warner Corp., York Div.—Henry M. Hasse was elected president and chief executive officer, and Stewart E. Lauer was named chairman of the board.

Hercules Galion Products, Inc.—D. J. Redmond has become director of sales.

GM Overseas Operations Div., General Motors Corp.—John W. Griswold is now public relations director.

Joseph T. Ryerson & Son, Inc.—L. Paul Lee is now manager of stainless steel sales at the Milwaukee plant.

Wayne Works, Inc. — Robert B. Kurre has been promoted to director of engineering.



*Parker Rust Proof Co. — E. B. Thompson was promoted to general sales manager.*

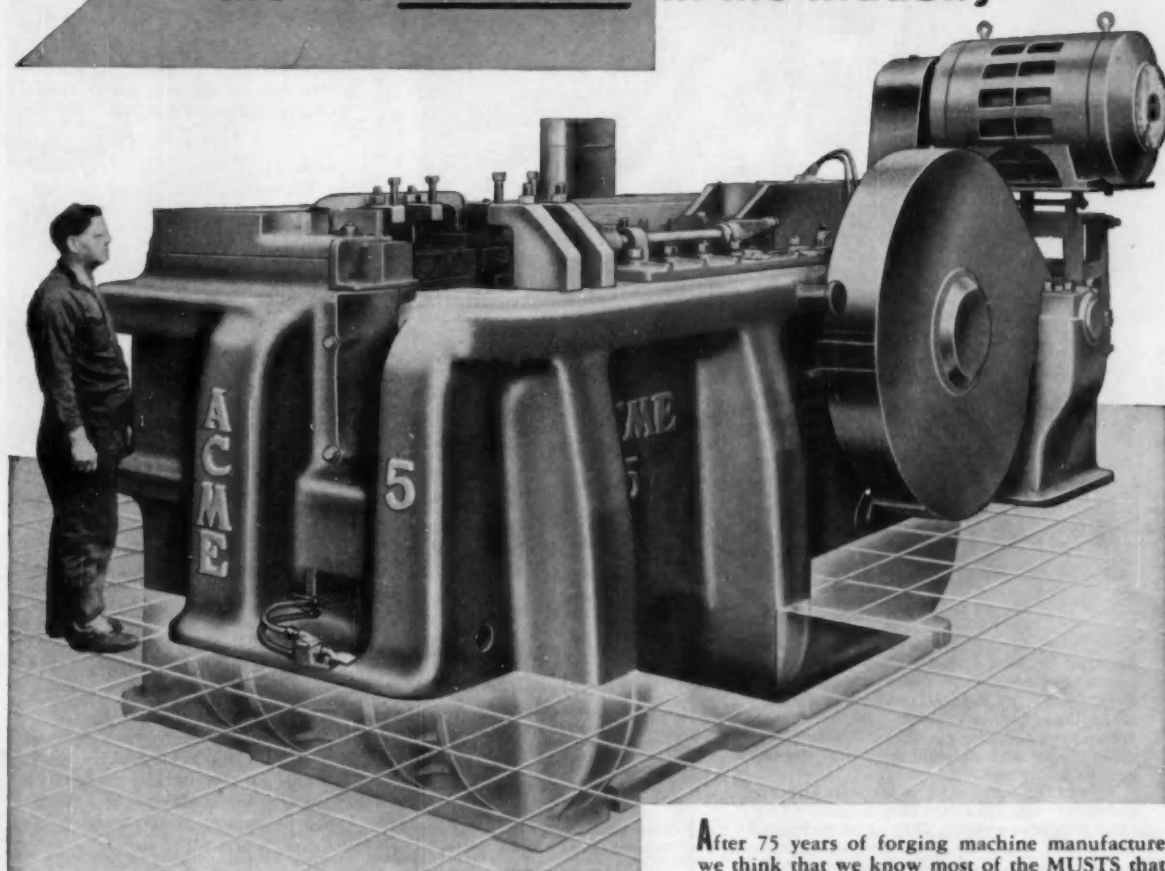
In forging machines—

TO GET  
YOU MUST HAVE

... **ACME XN**  
are the HEAVIEST

**PRECISION  
WEIGHT!**

**FORGING MACHINES**  
in the Industry



**5" ACME XN**  
**OVER 100 TONS of CONTROLLED PRECISION**

After 75 years of forging machine manufacture we think that we know most of the MUSTS that go into designing and building successful forging machines. One of those MUSTS is WEIGHT. Only recently we have added still more strength in one or two spots on ACME XN Forging Machines where greater rigidity will insure still greater accuracy and long term trouble-free operation. If you do not have the latest facts on ACME XN Forging Machines we invite you to determine for yourself just what progress has been made in modern forging machine equipment. *Bulletin 956 tells the story.*

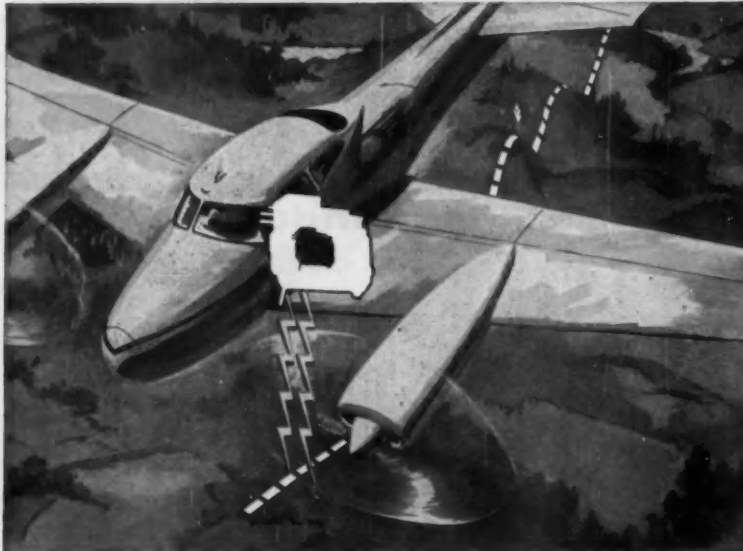
## **THE HILL ACME COMPANY**

**ACME MACHINERY DIVISION**  
**ESTABLISHED 1882**

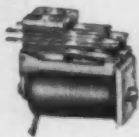
**1209 W. 65th St., Cleveland 2, Ohio**

**"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO  
MANUFACTURERS OF "HILL" GRINDING & POLISHING MACHINES  
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS  
BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES**

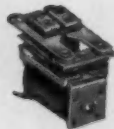
## Potter & Brumfield engineering is in this picture



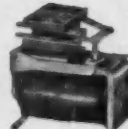
### Which P&B relay did Television Associates specify FOR THEIR AIRBORNE COMPUTER?



MH Series



MB Series



MC Series

Surveys for pipe lines, electric transmission routes and microwave paths are now made from the air, by radar. Television Associates of Indiana, Inc. developed this speedy new technique—and the equipment—which provides clients with detailed profiles of the terrain to be crossed.

Part of the equipment, an intricate airborne computer, requires relays that are fast-acting, light weight, versatile. They must have high shock and vibration resistance and remain operative in temperatures ranging from  $-45^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

Modified MH relays by P&B were specified. These miniature relays meet all Television Associates' requirements and provide high reliability in a mighty small package. Challenging relay problems are solved daily at P&B. Twenty-five years of creative engineering are behind every P&B relay. Write today for our new catalog.

P&B RELAYS AVAILABLE AT MORE THAN  
500 DISTRIBUTORS IN ALL PRINCIPAL CITIES

## Potter & Brumfield, inc.

PRINCETON, INDIANA Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

Manufacturing Divisions also in Franklin, Ky. and Laconia, N. H.



(Continued from page 37)

Robertshaw-Fulton Controls Co. has taken over Beta Corp. . . . Evans Products Co. will acquire most of the assets of Haskellite Manufacturing Corp.

\*\*\*

Oil Industry Information Committee has shortened its name to Oil Information Committee.

\*\*\*

General Electric Co. has made the Edmore, Mich., plant of the Metallurgical Products Dept. the Magnetic Materials Section of the department.

\*\*\*

Bell Aircraft Corp. may acquire more additional manufacturing subsidiaries in 1957.

\*\*\*

Acme Steel Co. has moved its general offices to 135th & Perry Ave., Chicago 27, Ill.

\*\*\*

Standard Pressed Steel Co. is expanding its Hallowell Steel Shop Equipment Div. . . . U. S. Rubber Co. is expanding its power transmission belt plant at Philadelphia, Pa.

\*\*\*

Anthony Co. is purchasing Truck Crane, Inc.

\*\*\*

A. O. Smith Corp. has formed a new subsidiary to provide engineering service to the company's 12 operating divisions and assistance to outside concerns in product design and other fields.

\*\*\*

Dana Corp. will build a modern new central office and warehouse facility for its Parts Div. in Toledo, O.

\*\*\*

American Chain & Cable Co., Inc., has launched an expansion and modernization program at its Wright-Manley facilities in York, Pa.

\*\*\*

Avco Mfg. Corp. plans to build a \$15 million research and development center near Boston, Mass., for the development of guided missile systems. . . . Armour Research Foundation has created a new combustion laboratory.

### ENGINEERING DATA

SERIES: MH Miniature Telephones.

CONTACTS: Up to 18 springs, maximum 1 in each stack, forms A, B, C, D, E, X and Y. AC relays are limited to a maximum of 2 poles. Various contact material available.

VOLTAGE RANGE: DC - .05 to 110 V.—AC - 6 to 230 V. 60 cycle.

COIL RESISTANCE: 22,000 ohms maximum.

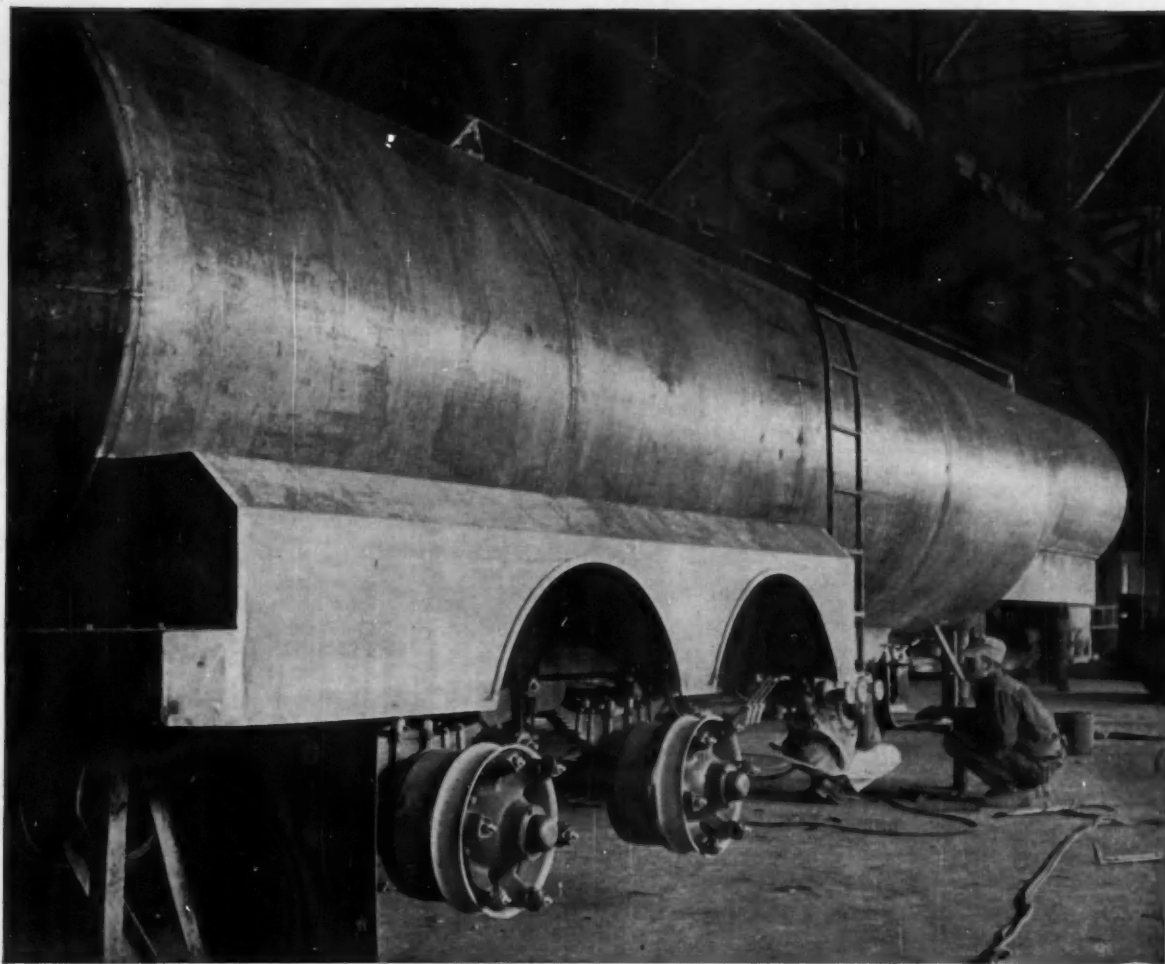
TEMPERATURE RANGE: High temperature range (DC)  $-55^{\circ}\text{C}$ . to  $+135^{\circ}\text{C}$ . Standard DC  $-55^{\circ}\text{C}$ . to  $+85^{\circ}\text{C}$ . Standard AC  $-45^{\circ}\text{C}$ . to  $+40^{\circ}\text{C}$ . Other temperature ranges available to specification.

TERMINALS: Standard pierced solder lug holes will take (2) No. 18 hook-up wires. Adaptable for printed circuits.

ENCLOSURES: Dust cover plus wide range of hermetically sealed covers and types of terminations.

DIMENSIONS: 1-9/16" L. x 25/32" W. x 1-3/8" H. (4c Relay).





## Where Deadweight Is The Target They're Choosing Mayari R

A pound of deadweight saved can be a pound of payload gained, assuming overall strength is constant. That's one of the reasons why designers of vehicular bodies for railway, highway and mine are turning more and more to Mayari R high-strength, low-alloy steel.

Mayari R has a yield point much higher than that of carbon steel, which permits its use in lighter thickness without sacrificing strength. Because of this, payload capacity has frequently been upped as much as 20 pct, with attendant economies and profits.

But deadweight-vs-payload isn't the only reason for the growing use of Mayari R. Corrosion, for example, sometimes heads the list of important factors. Mayari R offers 5 to 6

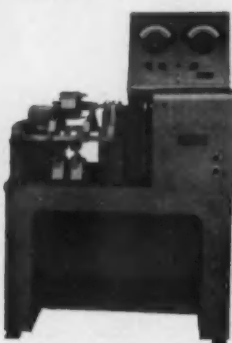
times greater resistance to atmospheric corrosion than plain carbon steel. Weldability, too, is a criterion in some applications. Mayari R welds as readily as carbon steel, and with virtually the same procedures and equipment. It also stands up well under impact and has superior resistance to abrasion and battering.

Our Catalog 353 contains technical details on Mayari R, plus scores of illustrated application stories. Designers and owners alike will find much of interest in this booklet, available through the nearest Bethlehem district office.

**BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.**  
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

## Mayari R... High-Strength, Corrosion-Resisting Steel



Vertical Static  
with Drill PressStatic-Dynamic  
Capacities: 3/16 lb. to 3000 lbs.

# Bring Balancing Costs

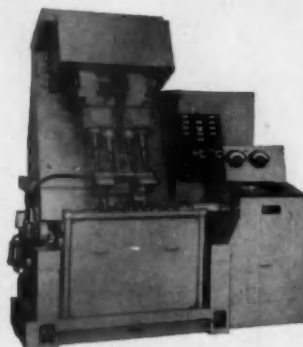
# DOWN

# with

# TINIUS OLSEN

# ElecDyne

# STATIC-DYNAMIC BALANCING MACHINES

Automatic  
Crankshaft Balancer

- **AUTOMATIC INDICATION**—both the amount and angle of unbalance are indicated instantly on separate meters. Even minute quantities of unbalance are pinpointed automatically. Guesswork and costly "trial and error" methods are eliminated.

- **UNMATCHED SPEED** for production line balancing. The operator simply inserts the part and starts the machine—within seconds the amount and angle of unbalance are known. On dynamic balancing machines, the movement of a switch changes the plane of correction automatically, and assures positive plane separation.

ElecDynes are also available with built-in drilling or welding equipment for on-the-spot correction of unbalance.

- **LOW COST**, high speed balancing means significant production savings for you.

Get the facts about TINIUS OLSEN Static-Dynamic Balancing Machines—horizontal or vertical models. Write today for Bulletin 49.



Trademark  
Reg. U.S. Pat. Off.

# TINIUS OLSEN

## TESTING MACHINE COMPANY

2090 EASTON ROAD • WILLOW GROVE, PA.

### Testing and Balancing Machines

## Industry News

(Continued from page 39)

### First Detroit Outlet Approved By Ford for British Vehicles

Increasing sales of its English-made cars in the U. S. has prompted Ford to establish its first imported car dealership in Detroit. European Motors, Inc., 7079 Gratiot Ave., Detroit, has been designated as the outlet for the cars.

The cars will be shipped direct from the Ford works at Dagenham, England, instead of being routed through New York or other eastern seaboard ports. Detroit will thus be established as the company's port of entry for the first time. The growth of the foreign-car market in the U. S. is pointed up in a report which shows sales of English-built Fords last year increased by 60 per cent over 1955.

### Goodyear Aircraft Slates Plant Addition In Akron

Production of rocket components by Goodyear Aircraft Corp. will be increased considerably when the company completes a one-story plant addition at Akron, O. Construction is scheduled to start soon.

The 20,000 sq ft plant is expected to be completed in 1957. Manufacturing equipment to be installed includes large tracer lathes, heat treating furnaces, and inspection and testing facilities.

### Automotive Muffler Industry Continues Dynamic Expansion

Now occupying fourth place in automotive replacement parts sales, the automotive muffler industry does a volume of approximately \$350 million worth of business a year. In addition, it exercises a far-reaching effect on such other industries as steel by its use of more than 200 million lb of the metal annually.

### Ford Ups Goal For Edsel Car

Edsel Division has revised upward its production goal for its new Edsel car, to be introduced next fall. The company believes the original forecast of 200,000 units for the initial year was conservative, and now has pushed this figure up. It did not indicate, however, what the first-year goal would be.

(Turn to page 132, please)



There's little quarrel in the diesel industry about the air-cooling principle being highly-desirable in a turbocharger. It eliminates the need for extra plumbing on installation, puts no additional burden on an engine's cooling system and makes for a lighter, smaller unit in relation to output.

AiResearch turbochargers now available have been designed on this principle — which promises to be universal in the future. In addition,

our units increase power up to 100% depending on design and application of your engine, cut fuel costs, reduce noise and decrease or eliminate smoking. The removable rotating assembly

makes them easier to maintain than other turbochargers.

We invite your inquiry on how you can improve the performance of your diesels by the application of our turbochargers.

#### BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

MODEL	T-10	T-14	T-15	T-30-2	T-30-6
Diameter — in. nom.	9	11.5	15.25	15.25	16
Length — in.	9	14.12	16.75	17.25	21.75
Weight — lb.	40	95	125	135	195
Output — lb/min.	25-40	35-65	35-65	70-95	115-175
(Standard Conditions)					

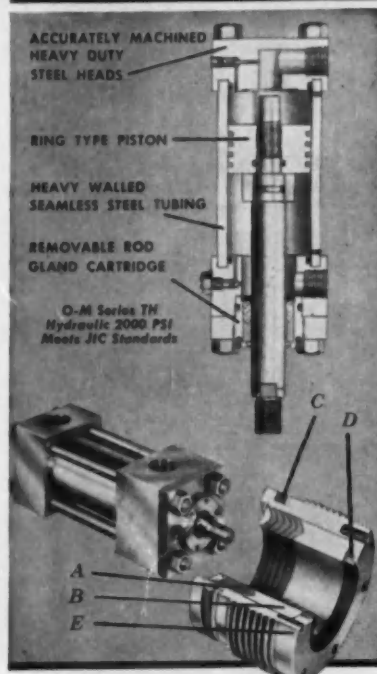


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## New O-M High Pressure Hydraulic Cylinder equipped with Removable Rod Gland Cartridge



The O-M-engineered removable Rod Gland Cartridge is constructed with a heavy wall steel shell threaded for quick, easy removal, and accurately piloted in rod head to assure perfect alignment. In most applications cartridge can be removed easily without removing mounts or the rod nuts. You simply loosen and remove with a spanner wrench.

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**B Rod Bearing**—Extra long, bronze rod bearing provides large bearing surface located well forward for maximum support of piston rod.

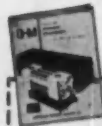
**C Cartridge "O" Ring Seal**—With leather back-up washer provides positive seal and acts as friction lock to retain cartridge.

**D Rod Wiper**—Homogeneous lip type located well forward to prevent accumulation of dirt in pocket. Metallic scraper (AN approved) available and interchangeable with wiper.

**E Pilot**—O.D. of cartridge serves as pilot for cylinders mounted on rod end.

O-M Series TH High Pressure Hydraulic (oil) Cylinders—conservatively rated at 2000 P.S.I.—are available in bore sizes 1½ to 8-inch inclusive. Descriptive drawings of cylinder, mounts, mounting brackets and capacity chart are

included in the new O-M Bulletin 105. Mail coupon for your FREE copy today.



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Company \_\_\_\_\_

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City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

## ON OUR WASHINGTON WIRE



Business spent \$85 billion on new structures and equipment for manufacturing establishments in the postwar period 1946-1956, according to a Commerce Dept. analysis. Two-thirds of this total represented purchase of equipment, and the remainder was spent for structures.

The Dept. of the Army announces that it will start field tests of an "aerial jeep" for military use by 1959. The jeep will mount two rotors for lift and will be able to move a payload equal to its own weight (1000 lb). Designed for short-range patrol work, this small aircraft will carry radio sets, machine guns, and possibly a 106 mm recoilless rifle.

The present Administration, reversing the trend of big government, has in the past three years discontinued almost 500 Government operations which were in

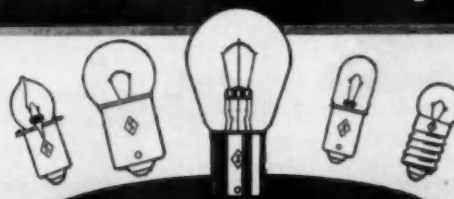
competition with private industry. The drive has already resulted in more than a billion dollars being turned over to the U. S. Treasury.

Sharper upturn is seen in the rate of contracting for work on the expanded Interstate highway system. Value of projects contracted for, plus those currently advertised, is crowding close to the \$1 billion mark. Orders have been let for 200 projects covering 500 miles of highway, to be built for \$289 million. Advertised and awaiting award are contracts for another \$622 million worth of work on 247 miles of highway.

Claims by military buyers that negotiation of contracts is necessitated by existence of a national emergency are on the decline. Senate Small Business Committee notes a decided drop in such claims since the final six months of 1955.

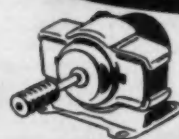
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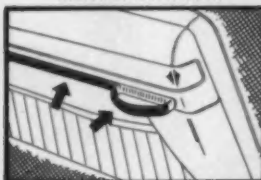


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Designed, developed, engineered and produced for one of America's finest motor cars, this robe cord and assist grip is typical of VOGT's ability to provide greater durability and exact color match at lower cost.



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\*Trade Mark Reg.

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### **BIG BROTHER BENDER**

Model 888



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MODELS  
AVAILABLE



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender.

### **AIR OPERATED MODELS IN FOUR SIZES**

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger dip response. Comes complete with dies, mandrels and wrenches — punching and blanking dies extra. Will punch holes up to 1" and form material up to 1/4" thick by 4" wide. We also build smaller models, hand or air operated, for bending materials up to 1/8" x 1 1/2".

Send for illustrated folder AMI-2

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## **THIS PAASCHE GUN IS A MASTER PAINTER'S DREAM**



**A Gun That Inspires Full Pride In Workmanship**



**PERFECT BALANCE:** The Paasche Model 21 has a compact head, a generous two-finger trigger with easy pull and a comfortable handle — all in perfect balance.

**INFINITE SPRAY PATTERN ADJUSTMENT:** The new dual purpose air valve permits the use of air from horn holes only,

center air cap holes only, or an intermixture of any proportion from these sources. The atomizing air control and the fan control afford infinite pattern adjustment with a minimum number of air caps.

**BUILT FOR HEAVY USE:** The one-piece heat-treated aluminum forged shell can really take abuse. Tough, durable anodized finish with chrome-plated drop forged brass fluid body make this a handsome gun that will not show wear. All internal metal parts are stainless steel. Teflon packing materials are self-lubricating, will not dry out.

**ECONOMY OF OPERATION:** Large, unrestricted air passages of short travel through the gun assure high volume of air atomizing even the heaviest materials at lower pressures.

**EASY MAINTENANCE AND SERVICING:** Gun body is well-rounded and highly polished making it easy to wipe clean. Cartridge type air valve assembly is easily removed for repair or replacement if ever required.

CONSULT YOUR CLASSIFIED DIRECTORY FOR NEAREST PAASCHE REPRESENTATIVE OR WRITE FOR INFORMATIVE BULLETIN.

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A DIVISION OF CLINE ELECTRIC MANUFACTURING CO.  
1909 W. DIVERSEY PARKWAY • CHICAGO 14

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# How Great Lakes Steel *teems* quality

You're up on the catwalk above the pouring platform along the open-hearth pit at Great Lakes Steel. Right below, one of the giant 250-ton teeming ladles is filling another train of hot-top ingot molds.

At no step in the production of good, deep-drawing steel is control of quality more important than in the teeming operation. For defects can easily develop *unless* the entire pouring operation is done exactly right . . . the way it is at Great Lakes.

For example, these hot-top molds are designed to eliminate shrinkage cavities in the finished product. A special lining compound of graphite or tar blankets the inside of every mold to form a highly protective shield for the delicate ingot surface.

And that's only a sample of the care Great Lakes takes *every step of the way* to maintain high and uniform quality steel!

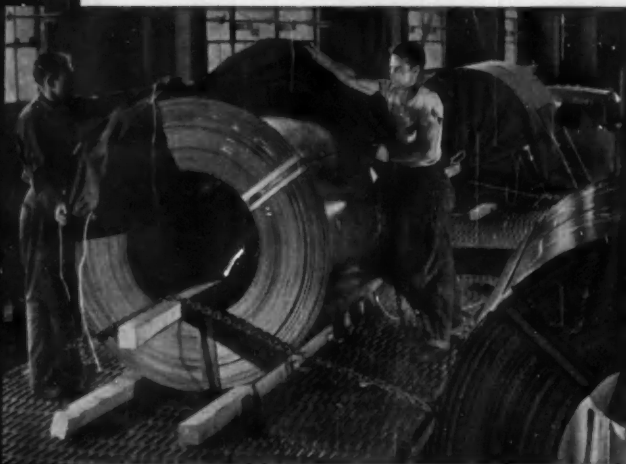
The easiest way to reach us? Simply phone our nearest representative.

## GREAT LAKES STEEL CORPORATION

Detroit 29, Michigan • A Unit of

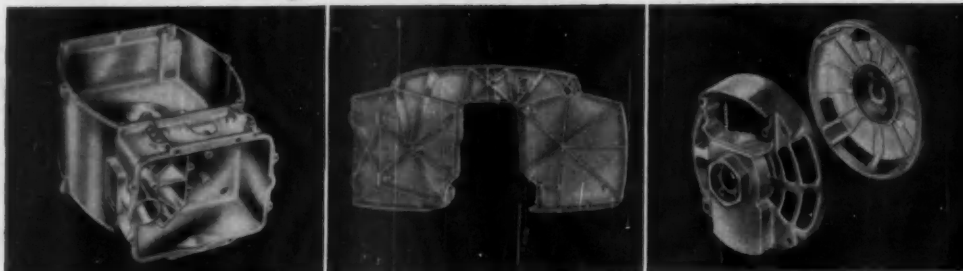
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*for die castings*



*...permanent mold castings*



*...impact extrusions*



Regardless of your product, if you use castings or impact extrusions, Thompson's experienced and creative engineers can show you where and how to simplify your operations and save on costs. Let us quote now on your plans. Just write, wire or phone Dept. AI-2, Light Metals Division, Thompson Products, Inc., 2269 Ashland Rd., Cleveland 3, Ohio, HEnderson 1-6765.

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# CLEAR-O-MATIC\*

## The All-Temperature Piston

UNIFORM SKIRT CLEARANCE FROM 20° BELOW ZERO TO 200° F

### STEEL TENSION MEMBER

Anchored only at pin bosses  
and cast in positive contact  
with I.D. of piston skirt

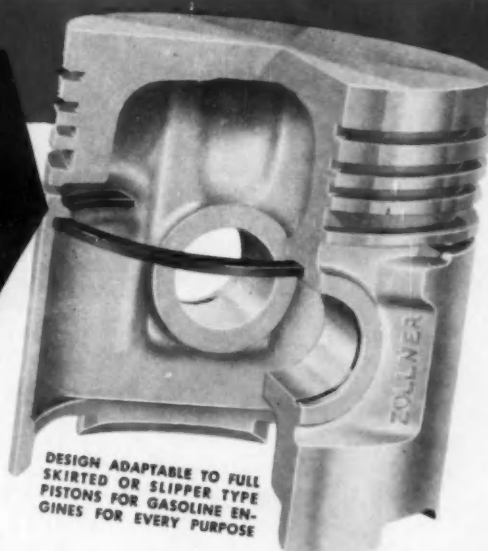
Controls Clearance Automatically

### Sensational Performance

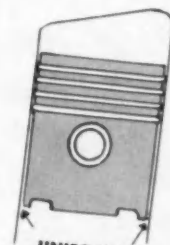
Requires less than .001 Clearance

Cold or Hot, Clear-O-Matic Piston clearance stays constantly uniform. Required clearance is reduced to less than .001. This great development of the "All-Temperature" Piston by Zollner engineers provides another fine feature attraction for the modern motor car . . . smooth, quiet running engine . . . no cold slap . . . reduced friction without loss of durability or heat conductivity . . . no danger of scuffing or seizing. We suggest a test of these sensational performance advantages for your engine.

\*T.M. Reg. Pat. App. For



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PISTONS FOR GASOLINE EN-  
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UNIFORM  
EFFECTIVE SKIRT  
CLEARANCE  
AT ALL  
TEMPERATURES

- 1 Clearance maintained uniformly at all coolant temperatures from 20° below zero to 200° F.
- 2 Effective expansion identical with ferrous cylinder.
- 3 Steel tension member, with same effective expansion as cylinder, maintains uniform skirt clearance through entire temperature range.
- 4 Normal diametric clearance usually less than .001 with uniform skirt bearing.
- 5 Durability and conductivity comparable to heavy duty design.

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PISTONS

THE ORIGINAL EQUIPMENT PISTONS

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# SHULER'S NEW T18C AXLE

is **LIGHTER** Than Ever,  
**STRONGER** Than Ever

Shuler axles, with their one-piece forged design, have led the "weight-strength" parade for years.

Now Shuler offers T18C series axles with *new forged steel hubs* and *new lightweight drums*. They give you the greatest possible weight saving with maximum strength. The new hubs weigh less than magnesium or aluminum hubs—over 70 pounds saving in weight at no extra cost over ordinary malleable iron hubs! And remember—Shuler axle centers are "one piece"—made of controlled analysis premium steel, forged and heat treated throughout to insure even toughness *all over*, to eliminate every possibility of failure due to uneven metal structure.

Want more facts? Write us for complete information. You'll discover why more and more automotive equipment manufacturers are specifying Shuler One-Piece Tubular Axles.

## NEW MODELS INCLUDE:

- 1 New lightweight but permanent malleable brake shoes and removable spiders.
- 2 Roller Shafts are fitted into the shoes with precision-machining, to insure full bearing, and are then locked in place. *They can't fall out.*
- 3 Positive locking "roll pins" in the anchor pins.
- 4 Parkerized and hardened cam rollers for rust-proofing and long service.
- 5 Nylon inner and outer cam-shaft bushings.
- 6 Self-aligning "ball and socket" aluminum cam-shaft housing.
- 7 One piece forged and heat treated cam, precision ground and uniformly hardened at wearing surfaces.



## NEW DRUM REDESIGNED FOR MORE STRENGTH, LESS WEIGHT

Notice those "butterflies" that encircle the perimeter of the new Shuler drum. They're the secret of its light weight and maximum strength. Unneeded, dead-weight metal has been eliminated—but *where strength is needed, the drum has actually been "bumped up"*. Engineering like this, and one piece forged axle design, make Shuler axle assemblies lighter than competitive makes. And Shuler maintains this lighter weight with top quality brakes, genuine malleable iron brake shoes, and greater area replaceable brake linings!

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